

US EPA ARCHIVE DOCUMENT

# 2010 PROGRESS REPORT

## USEPA PROJECT XL

Buncombe County Bioreactor Project

Buncombe County Solid Waste Management Facility  
Alexander, North Carolina



September 2011

**CDM**

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## Executive Summary

Under the United States Environmental Protection Agency's Project XL, Buncombe County, North Carolina has constructed and is currently operating a combined leachate recirculation and gas recovery system at its Subtitle D landfill. The project intent is to demonstrate that leachate can be safely recirculated over an alternative liner system. The County also expects to increase the life of the landfill as a result of leachate recirculation.

The Buncombe County Solid Waste Management Facility is located in the mountains of western North Carolina, approximately nine miles north of the city of Asheville. The 557 acre solid waste management facility opened in 1997 with a Subtitle D landfill disposal area that comprises approximately 100 acres.

This project differs from other Project XL projects in that it is a full-scale implementation of a bioreactor system that is being performed in two phases over an extended period of time.

Phase 1 is a retro-fit bioreactor system that entails installing trenches after landfill cells are filled to capacity. The Phase 1 Retrofit System was installed in Cells 1-5 and has been in operation since April 2006.

Phase 2 is a build-as-you-go bioreactor system which means that the infrastructure is installed in stages as the waste is being placed. The build-as-you-go approach will provide a more extensive wetting of the waste and earlier capture of landfill gas. The first stage of the Phase 2 system is anticipated to be installed in Cell 6 in 2011.

This project was granted regulatory flexibility to apply liquids other than leachate to the waste. To date only leachate has been used since there has been adequate leachate available onsite to meet the needs of the project. This may change when Phase 2 of the project is activated since it is expected that the quantities of liquid addition will increase.

In 2010, the County began construction of a landfill gas-to-energy project at the site. Part of the project includes the installation of 25 vertical gas wells in Cells 1-5. Initially it was thought that these wells would serve to supplement the horizontal gas collection trenches of the bioreactor system. But, ultimately it was decided that dedicating the bioreactor trenches to leachate recirculation and using the vertical wells for gas collection would be simpler to operate and provide a more consistent flow of landfill gas to the electrical generators.

As of this stage of the project the alternative liner system is functioning at a comparable level to the prescriptive Subtitle D liner system. While liquids have been observed in the leak detection zones of the landfill cells, testing of LDZ samples indicates that it is groundwater. Modifications will be made to the leak detection zones of the future cells to limit the potential for groundwater intrusion.

To date, approximately 1.6 million gallons of leachate has been recirculated resulting in 320 less truck trips to the wastewater treatment plant (WWTP). That has resulted in savings of approximately \$78,000 in avoided hauling and treatment costs. With the planned expansion of the bioreactor system into Cell 6, the largest cell of the landfill, the amount of leachate that can be recirculated will be significantly increased. It is anticipated that hauling of leachate will not be required outside of the winter season once the Cell 6 system is operational.

# Section 1

## Introduction

### 1.0 Introduction

The Buncombe County Solid Waste Management Facility is a host site for a bioreactor project being conducted under the USEPA Project XL Program. The purpose of this report is to present the progress of the bioreactor project since it began operation in April 2006. This initial progress report which pertains to project activities through 2010 was prepared by Kristy Smith - Buncombe County Bioreactor Manager, Christopher Gabel - Camp Dresser and McKee (CDM) Senior Design Engineer and Ravi Kadambala - CDM Project Engineer.

#### 1.1 Site Description

The Buncombe County Solid Waste Management Facility is located in the mountains of western North Carolina, approximately nine miles north of the City of Asheville. The 557-acre solid waste management facility (refer to Figure 1-1) opened in 1997 and comprises a Subtitle D landfill, construction and demolition (C&D) landfill, wood waste mulching facility, convenience center for residential drop-off, a household hazardous waste (HHW) facility, and a white goods and tires holding facility.

The Subtitle D landfill is 95 acres and consists of 10 disposal cells that are being constructed sequentially over the estimated 30+ year life of the facility. Cells 1 and 2 were constructed with a prescriptive RCRA Subtitle D liner system consisting of a 24" soil barrier layer with a maximum permeability of  $1 \times 10^{-7}$  cm/sec, a 60-mil high density polyethylene (HDPE) liner and a 24-inch rock drainage layer. Cells 3-6 were constructed with an alternative liner system that uses an 18-inch soil barrier layer with a maximum permeability of  $1 \times 10^{-5}$  cm/sec, a geosynthetic clay liner (GCL), a 60-mil HDPE liner and a 24" rock drainage layer.

Cells 1-5 are filled to capacity and Cell 6 has been the active disposal cell since 2006. Based on current waste flows Cell 7 is expected to begin operation in 2015.

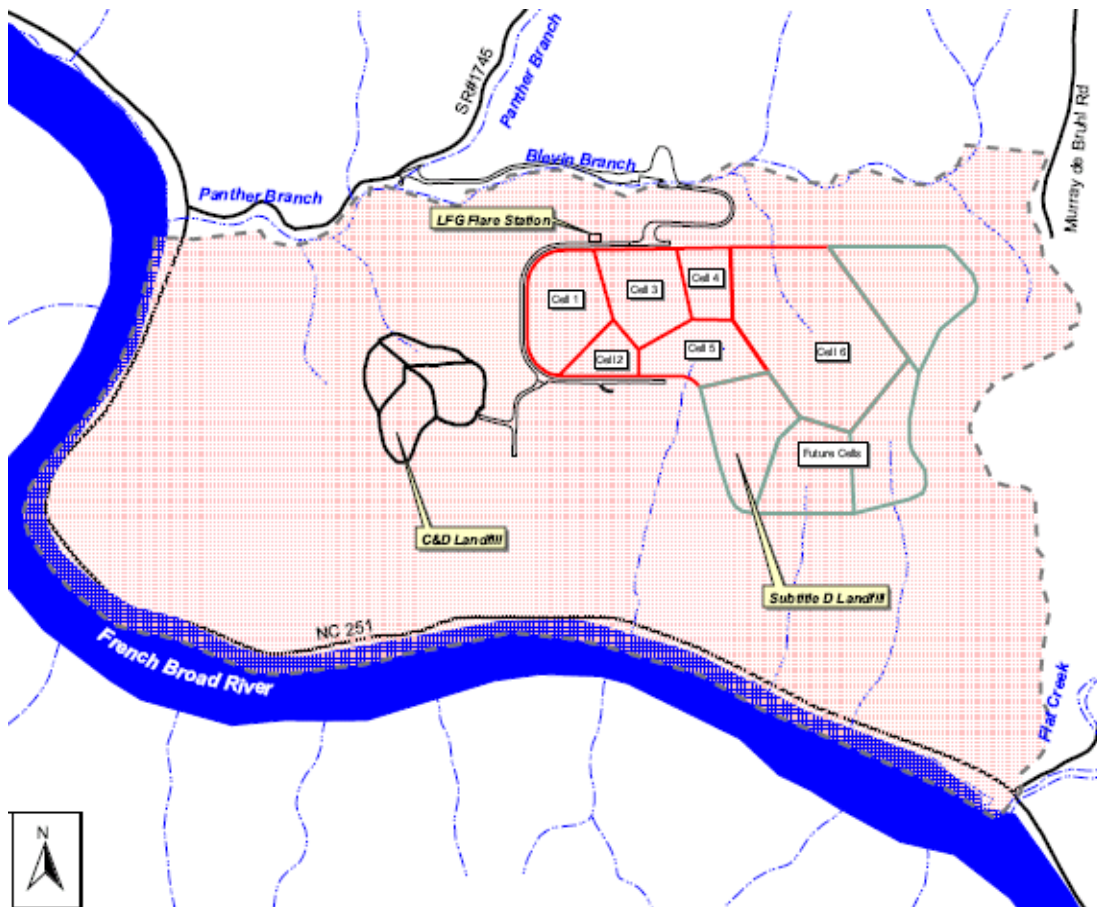


Figure 1-1 Buncombe County Solid Waste Management Facility

## 1.2 Project Goals

In spite of increasing rates of recycling, landfills remain the primary means of managing solid waste in the US, receiving 54% of the waste generated in 2008 (EPA-530-F-009-021). Municipal solid waste (MSW) landfills in the United States are designed in accordance with the technical guidelines provided in Subtitle D of the Resource Conservation and Recovery Act (RCRA) which requires that landfills be equipped with impermeable base liners and caps. While this requirement has been very successful in preventing groundwater contamination it has also led to the dry entombment of waste at many landfill sites. Some concern has been raised regarding the long term containment of undecomposed waste and the potential for leachate releases after the post-monitoring period ends (typically 30-years).

One proactive approach to address this concern is to operate MSW landfills as bioreactors. A bioreactor landfill uses controlled methods of liquids addition to increase waste moisture content as a means for accelerating the decomposition process. The ultimate goal of a bioreactor operation is to achieve a stabilized condition while the landfill is still under operation. The bioreactor process has been applied at numerous landfill sites in the US with largely favorable results.

Federal regulations governing solid waste management restrict liquid addition to only those landfills equipped with prescriptive Subtitle D liner systems. The Buncombe County Bioreactor Project seeks to

determine what impact, if any; liquid addition has on alternative liner systems by comparing the performance of the prescriptive Subtitle D liner system in Cells 1 and 2 to the alternative liner systems in Cells 3-10. The data obtained from this project are anticipated to provide scientific basis for modifying federal regulations to allow liquid addition in MSW landfills equipped with alternative liner systems.

A Final Project Agreement (FPA) was issued by the USEPA under the Project Excellence and Leadership Program (Project XL) approving Buncombe County's proposal to incorporate a bioreactor process as an integral part of their landfill operation. This document, which is provided in Appendix A, provides the design, execution, and monitoring framework developed for the project.

### 1.3 Public Awareness

Public awareness has been an important part of the County's solid waste program since the siting of the facility in the early 1990's. To increase public awareness of the bioreactor project the County staff have given presentations to various groups, led tours for local area colleges and high schools, and performed a live interview at the bioreactor site for Buncombe County Television. The County also has a website that is available to the public to learn about the project. The website is updated semi-annually with new monitoring data and other information and is accessible at:  
<http://www.buncombebioreactor.com/index.html>.

## Section 2 System Description

### 2.0 System Description

This project differs from other Project XL projects in that it is a full-scale implementation of a bioreactor system that is being performed in two phases over an extended period. Phase 1 is a retro-fit bioreactor system that entails installing bioreactor infrastructure after cells are filled to capacity. The Phase 1 Retrofit System is installed in Cells 1-5 and has been in operation since April 2007.

Phase 2, which has not started yet, will be a build-as-you-go bioreactor system which means the infrastructure is installed in multiple stages as the waste is being placed. The build-as-you-go approach allows a more extensive wetting system to be installed and it provides early capture of landfill gas. The first stage of the Phase 2 system will be installed in Cell 6 in October 2011.

#### 2.1 Leachate Recirculation

As described in the FPA this project was granted regulatory flexibility to add liquids to cells with alternative liner systems and to apply liquids other than leachate to the waste mass. To date only leachate has been used since there has been adequate leachate available onsite to meet the needs of the project. This may change when Phase 2 of the project is activated since it is expected that the quantities of liquid addition will increase.

Leachate recirculation is not performed during the winter months due to concern of the negative impacts of cold leachate on the propagation of methanogenic bacteria. The project team, in consultation with the project academic advisors, Dr. Morton Barlaz of North Carolina State University and Dr. Debra Reinhart of The University of Central Florida, established a minimum leachate temperature of 50 degrees F for the recirculation operation as measured at the leachate pond. This will also apply to any other liquids used for the project.

A significant portion of the landfill had already reached capacity when the project began, prompting the need to install a retrofit system. The Phase 1 Retrofit System is equipped to recirculate leachate using a combination of horizontal injection trenches (HIT) and surficial gravity trenches (SGT) as shown in Figure 2-1.



Six HIT were installed at intermediate depths in the retrofit area. The first three HIT were installed in anticipation of the project being approved when the top of waste was at Elevation 2040. They extend approximately 400-ft south into the waste mass and are spaced 100-ft apart. Three additional HIT were installed at Elevation 2080 using the same spacing and extend approximately 800-ft east in the waste. Due to the longer length of these HIT, two pipes were used in the trenches to provide more uniform distribution of leachate. This is achieved by using one short pipe that wets the first 400-ft of the trench and one long pipe that wets the latter half of the trench.

Five SGT ranging in length from 450 to 600-ft were installed at Elevations 2030 (SGT 1), 2050 (SGT 2 and 4) and 2070 (SGT 3 and 5). The trenches were excavated 11-ft into the waste and capped with a clayey soil to provide containment of the recirculated leachate and allow gas collection. Due to their shallowness SGT are operated differently than the HIT. The HIT are allowed to be pressurized up to 10 psi while recirculating leachate to provide greater lateral distribution while the SGT are operated as a gravity feed system to avoid leachate seeps from the side slopes of the landfill.

Construction details of the HIT and SGT are shown in Figures 2-2 and 2-3.

The Phase 2 Build-As-You-Go System will be installed in Cells 6-10. The proposed plan is to install the HIT approximately every 30-vertical feet at a horizontal spacing of 100-ft. Dual piping may be used in trenches greater than 500-ft in length.

Leachate recirculation quantities are limited to approximately 30,000 gallons per injection event for a single HIT and 8,000 gallons for SGT based on the holding capacity of the conduits. The liquids addition process typically takes between 2 to 6 hours per event and is continuously supervised by the Bioreactor Manager. A rotation schedule is used to allow time between injection events for leachate to drain. The rotation schedule is adjusted as needed to account for the varying rates of drainage of the HIT and SGT. Leachate recirculation is reduced or suspended during periods of rainfall until the area dries out sufficiently. The landfill side slopes are carefully inspected during and after each injection event for leachate seeps. To date, leachate seeps have been minimal.

## 2.2 Gas Collection

All of the SGT and HIT in the retrofit system are equipped to collect landfill gas as well as recirculate leachate. Collected gas is combusted at the flare station installed as part of the Phase 1 construction. Gas is also collected from the leachate collection system of each cell to provide added control of gas emissions.

In 2010, the County began construction of a landfill gas-to-energy project. Part of the project included the installation of 25 vertical gas wells in Cells 1-5 as shown in Figure 2-4. Initially it was thought that these wells would serve to supplement the gas collection capabilities of the HIT and SGT installed in the Phase 1 Retrofit System. But the final decision was to dedicate the HIT and SGT to leachate recirculation and only use the vertical wells for gas collection. This approach will provide a more reliable flow of landfill gas to the electrical generators. In compliance with this decision, the gas wellheads were removed from the HIT and SGT and were used in the construction of the vertical wells.



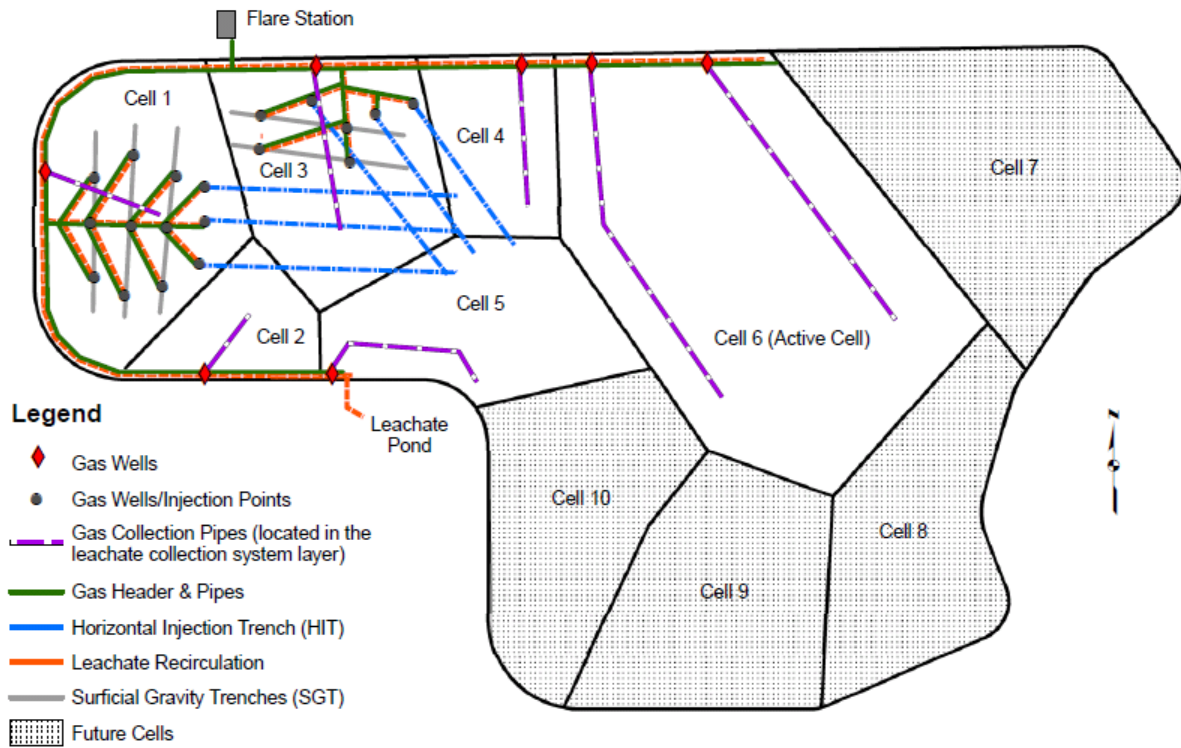


Figure 2-1 – Phase 1 Retrofit Bioreactor System

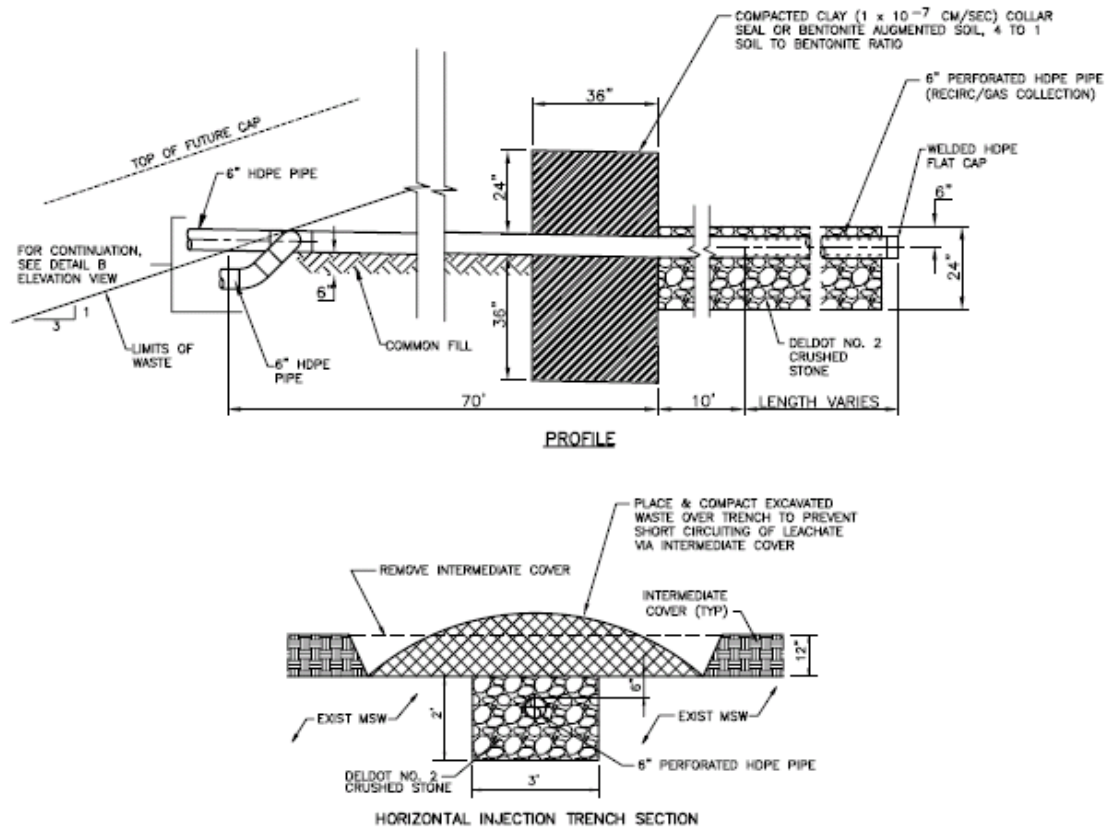


Figure 2-2 – Horizontal Injection Trench Detail

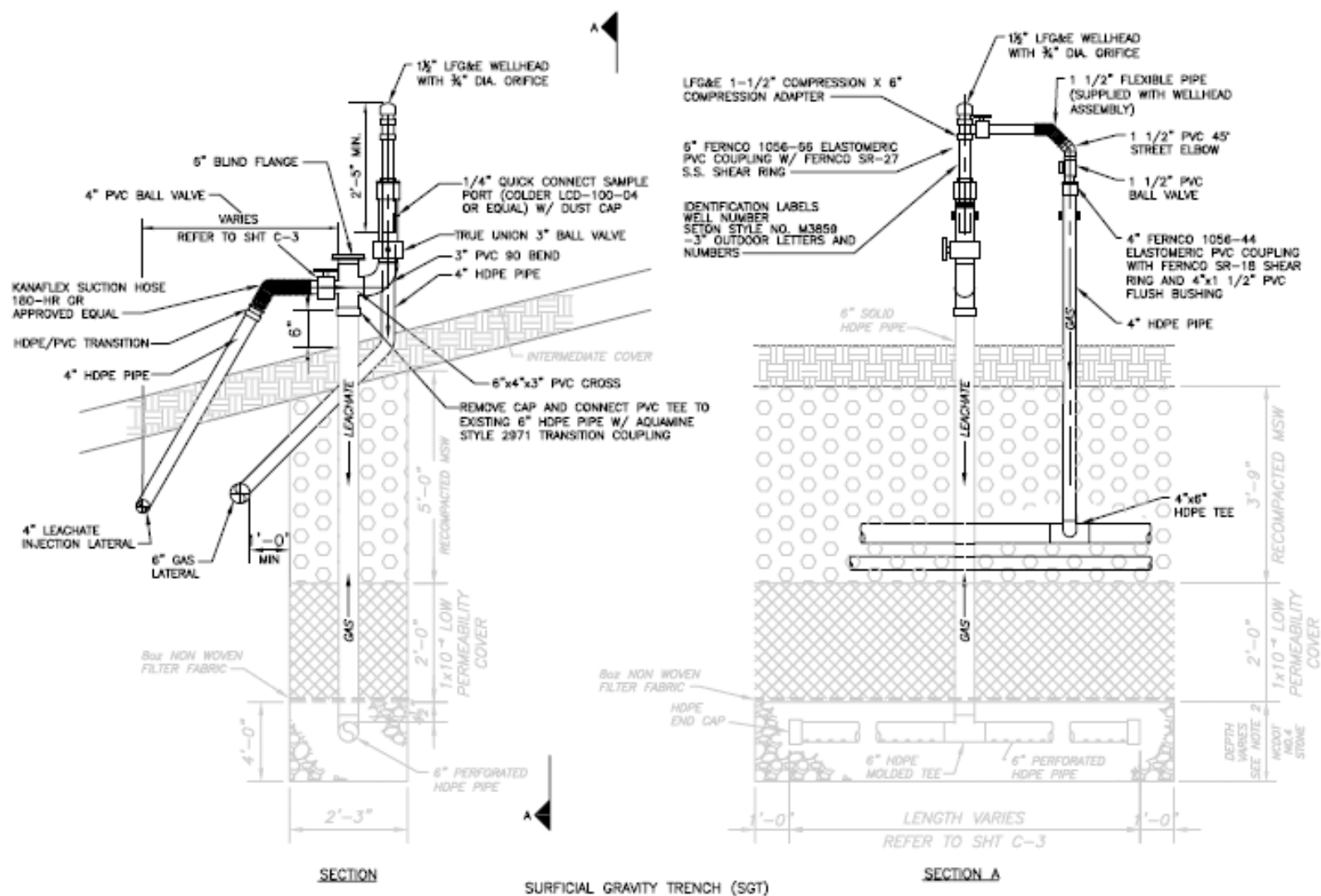


Figure 2-3 – Surficial Gravity Trench Detail



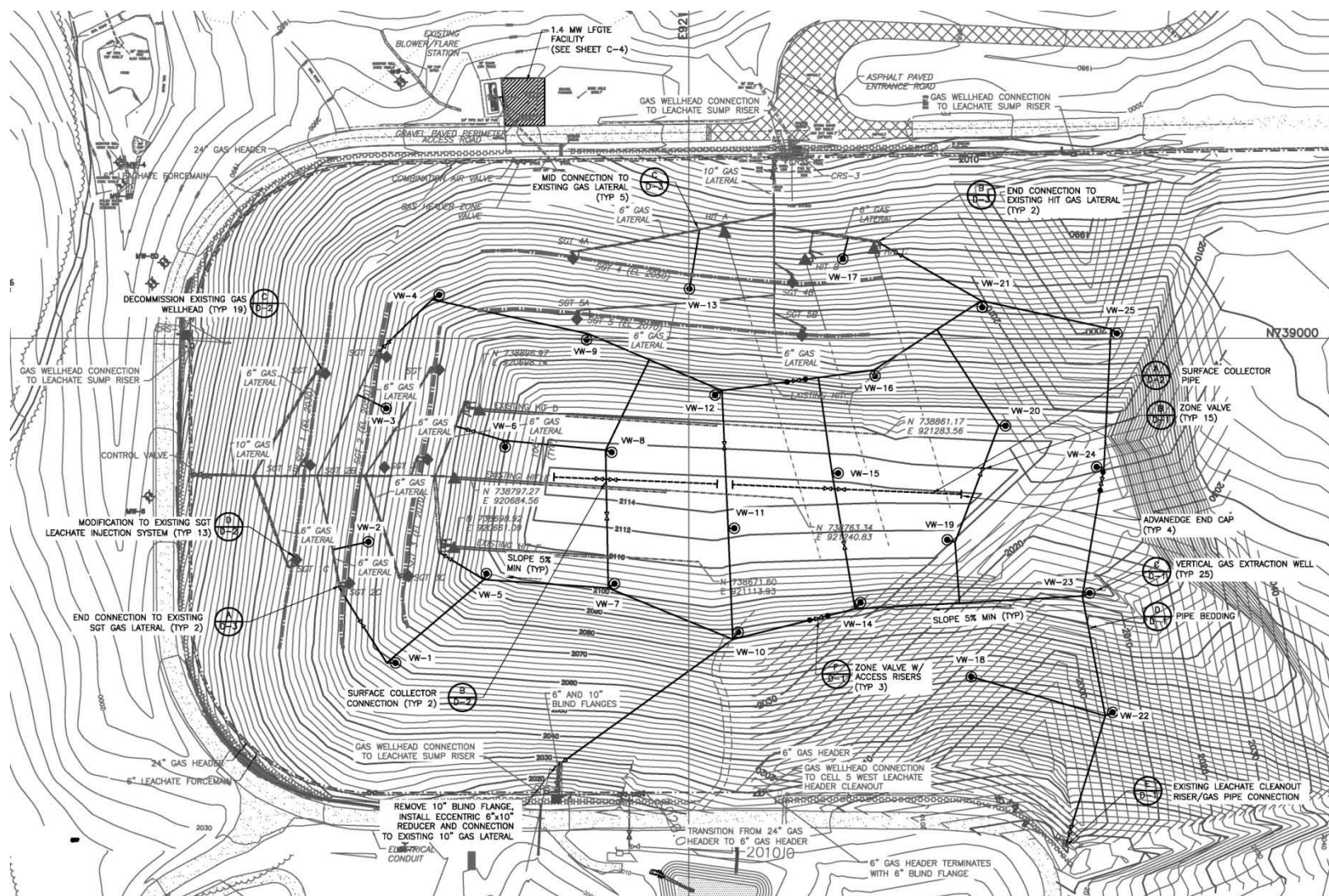


Figure 2-4 - Vertical Gas Well Collection System in the Retrofit Area

## Section 3

# Monitoring Program

### 3.0 Monitoring Program

#### 3.1 Program Overview

The field sampling and onsite record keeping are performed by the Bioreactor Manager. CDM is responsible for uploading data to the project website. Monitoring of the bioreactor system is being conducted to assess its performance as compared to the project goals. The monitoring data is also useful for the Bioreactor Manager in fine tuning the system operation.

The program content is largely based on the recommendations of our academic advisors who have extensive research experience at other bioreactor sites. Table 3-1 shows the monitoring parameters and frequency of data gathering for the Phase 1 Retrofit System. Parameters and frequencies may be adjusted when the new HIT in Cell 6 are put into operation as discussed in Section 6.

Parameter	Frequency
Leak Detection Quantity	Monthly
Leak Detection Quality	Monthly
Leachate Quality	Quarterly
Leachate Quantity	Weekly
Leachate Recirculation Quantity	Ongoing
Gas Composition	Intermittent
Gas Volume and Flow Rates	Intermittent
Settlement	Quarterly

Table 3-1 – Phase 1 Monitoring Parameters and Frequencies

In addition to monitoring for the bioreactor program, Buncombe County is also required to perform semi-annual testing of the leak detection zones (LDZ), groundwater monitoring wells, leachate pond, and stormwater collection points for the 2L groundwater standards established by North Carolina Department of Environment and Natural Resources.

### 3.2 Leak Detection

Each of the landfill cells and leachate pond are equipped with a leak detection zone (LDZ) located beneath the leachate collection system sump. The zones, as shown in Figure 5-1, are approximately 1 acre in size and consist of a 60 mil HDPE geomembrane and a 24-inch rock drainage layer located 3-ft below the bottom of the liner system. The LDZ are sloped to direct liquid to a collection pipe located directly below the leachate sumps. For Cells 3-6, liquid captured in the LDZ is pumped out through vertical stand pipes located along the perimeter berm. Cells 1 and 2 drain liquid through gravity pipes that protrude from the outer slope of the landfill berm. The drain pipes are equipped with gate valves that the operator opens to check for liquid.

If liquid is present in the LDZ of Cells 3-6, it is pumped out and offloaded in the leachate storage pond. The quantity of liquid pumped is recorded and samples of the liquid are tested onsite using a Horiba U-22 water quality meter for:

- pH
- Temperature
- Conductivity
- Dissolved oxygen
- Turbidity
- ORP (oxidation reduction potential)
- TDS (total dissolved solids)

Quantity and quality data are documented for each monitoring event in a log maintained by the Bioreactor Manager.

For Cells 1 and 2, the valves on the drain pipes are opened to check for the presence of liquid in the LDZ. If liquid is present, a sample is taken for quality testing. Quantity data is not recorded for Cells 1 and 2 since they are remote, gravity drain discharge points that cannot be accessed by the vacuum truck.

### 3.3 Leachate

The quantity of leachate collected is also tracked separately for each cell on a weekly basis. Each cell has a dedicated leachate pump system equipped with a flowmeter that allows the Bioreactor Manager to monitor the number of operating hours for the pumps, the quantity of leachate pumped, and the leachate level in the sumps at the time of monitoring. This data is recorded onto a field form by the Bioreactor Manager.

Leachate quality sampling occurs every quarter. Samples are collected from the leachate pond and from Cells 1-6. The samples are taken from sampling ports located in the valve vaults of the leachate pump stations. Leachate samples are collected in sample bottles and sent to Pace Analytical for analysis of:

- BOD<sub>5</sub> (Biological Oxygen Demand)

- pH
- COD (Chemical Oxygen Demand)
- Ammonia
- Specific Conductance

On-site analysis of the leachate is also performed using a Horiba U-22 water quality meter. The Horiba unit tests for:

- pH
- Temperature
- Conductivity
- Dissolved oxygen
- ORP
- TDS

The sampling process is dated and recorded in a monitoring log by the Bioreactor Manager.

### 3.4 Leachate Recirculation

The quantity of leachate recirculated is recorded for each injection event using the magnetic flow meter installed at the leachate pond pump station. The Bioreactor Manager records the quantity of leachate injected and identifies the specific HIT/SGT used for the injection event.

### 3.5 Landfill Gas

The gas collection component of the Phase 1 Retrofit System has operated intermittently due to insufficient flow rates. The system was only capable of operating above the minimum flow rate of the flare station (300 scfm) for brief periods of time before shutting down. When the system was active, total gas flow rates were recorded at the flare station and individual flow rates were recorded at the wellheads of the HIT and SGT. Flow rates and gas composition are measured at the wellheads using a Landtec GEM2000 meter. Monthly data gathering is expected to begin when the landfill gas-to-energy facility begins operation in mid-2011.

### 3.6 Landfill Settlement

Settlement plates were installed in 10 locations within the Phase 1 retrofit area as shown in Figure 3-1. The plates are surveyed quarterly to monitor the rate of waste settlement. Topographic surveys are also performed of the waste surface to monitor settlement.





3-4



## Section 4

### Collected Data

#### 4.0 Collected Data

The monitoring data collected through December 2010 for the project are presented below in summary graphs. A complete compilation of all data collected to date is provided in Appendix B.

##### 4.1 Leak Detection Quantity and Quality

Table 4-1 shows the annual quantity of liquid collected from the LDZ. Liquids have been observed in the LDZ of Cells 1 and 2; however they are not accessible for a tanker to collect and measure the quantity.

Sample Year	Cell 1 (gallons)	Cell 2 (gallons)	Cell 3 (gallons)	Cell 4 (gallons)	Cell 5 (gallons)	Cell 6 (gallons)	Leachate Pond (gallons)
	<b>Subtitle D Liner</b>		<b>Alternative Liner</b>				
2007	NA	NA	427	0	0	340	0
2008	NA	NA	3,105	25	2,925	10,475	0
2009	NA	NA	1,375	0	3,300	5,500	0
2010	NA	NA	1,040	0	6,465	3,835	0
Cumulative	NA	NA	5,947	25	12,690	20,150	0

NA – Unable to measure quantity.

Table 4-1 – Annual Amount of Liquid Collected from LDZ

Figure 4-1 shows the monthly quantities of liquid collected from the LDZ of Cells 3-6 and the pond. Figures 4-2 through 4-8 show analytical data for the liquid collected from the LDZ. Turbidity readings were not taken after June 2010 due to a malfunction of the turbidity meter.

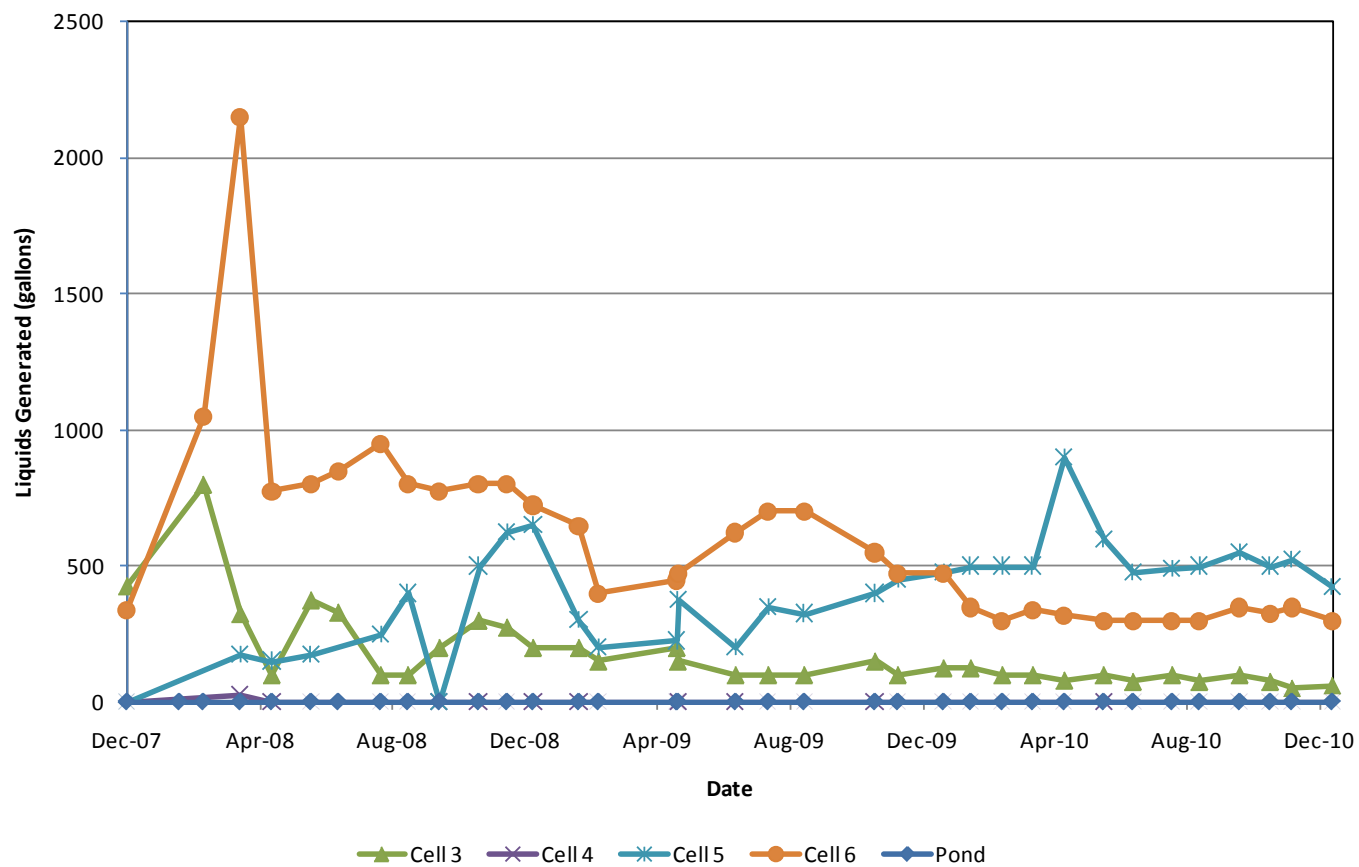


Figure 4-1 – Monthly Leak Detection Volumes for Cells 1-6

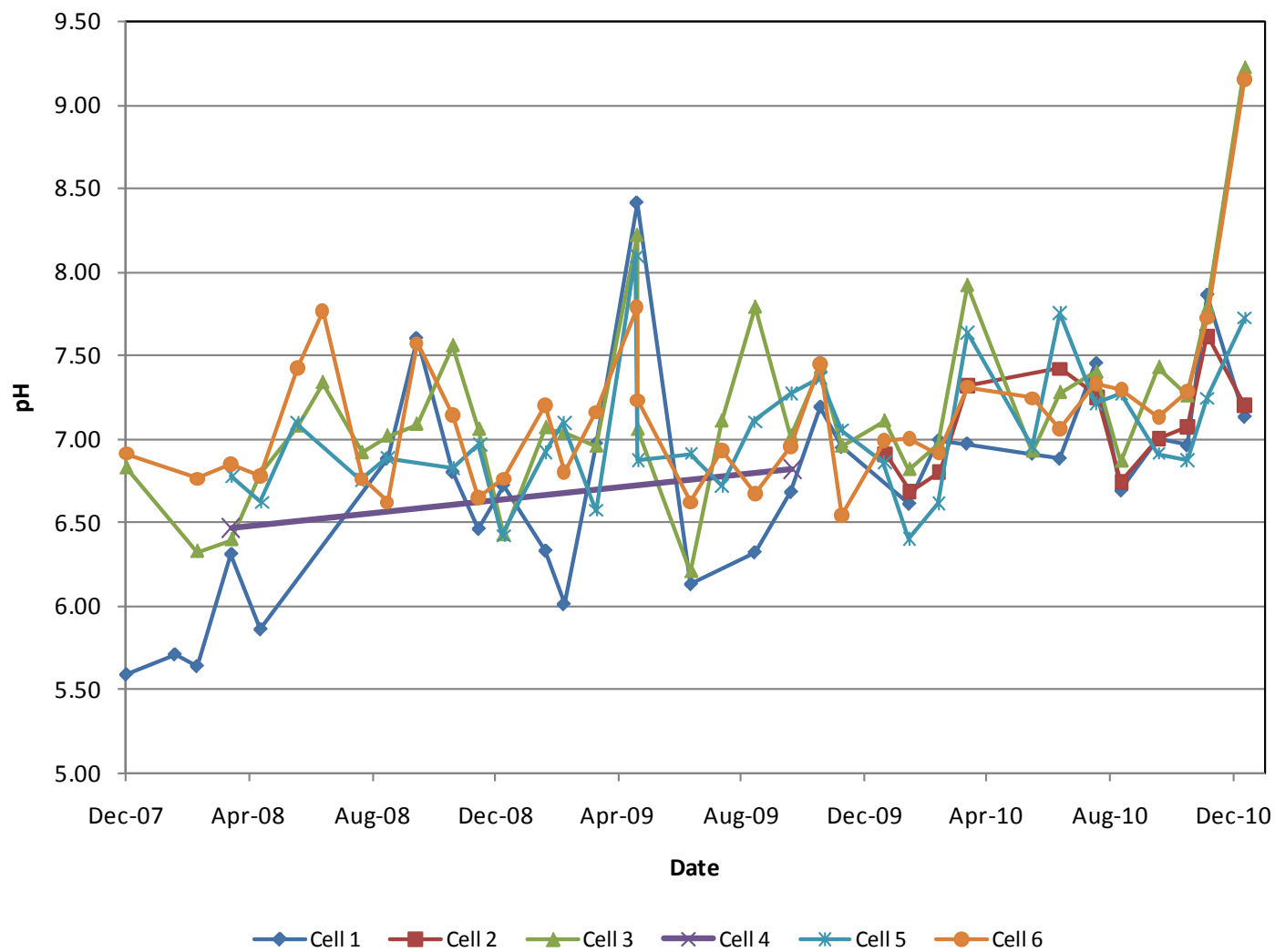


Figure 4-2 – pH of Liquid in Leak Detection Zones

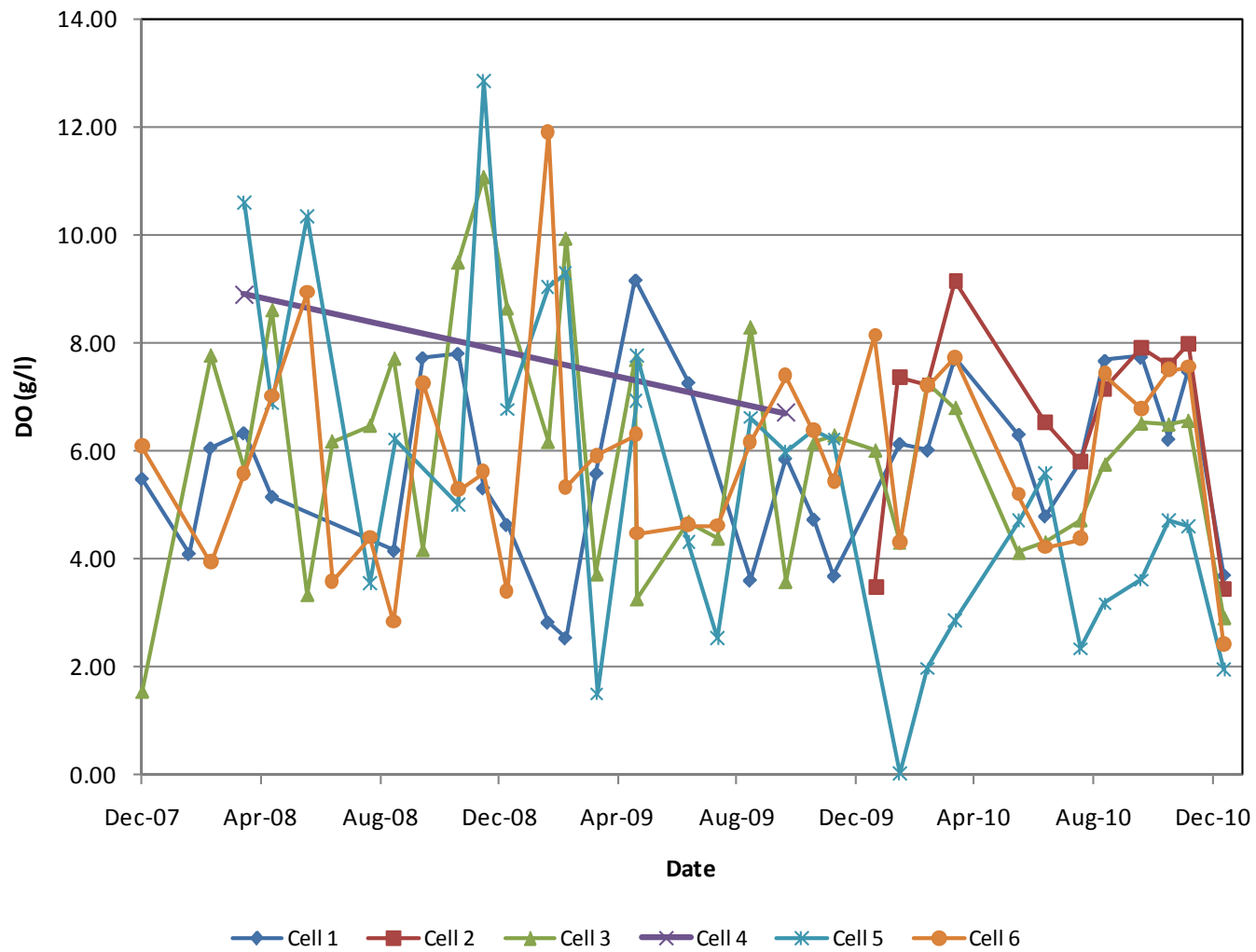


Figure 4-3 – Dissolved Oxygen of Liquid in Leak Detection Zones

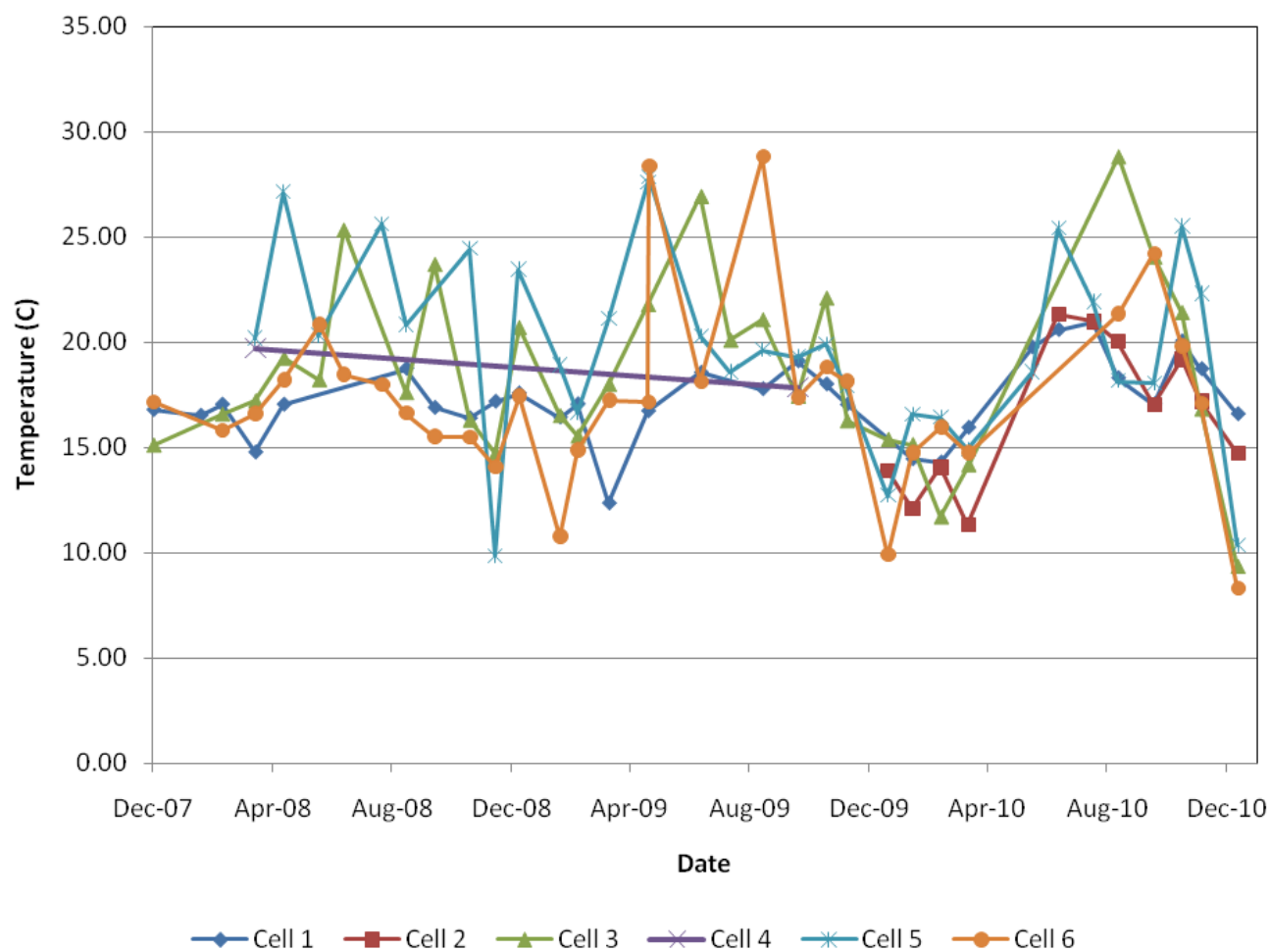


Figure 4-4 – Temperature of Cells 1-6 in Leak Detection Zone

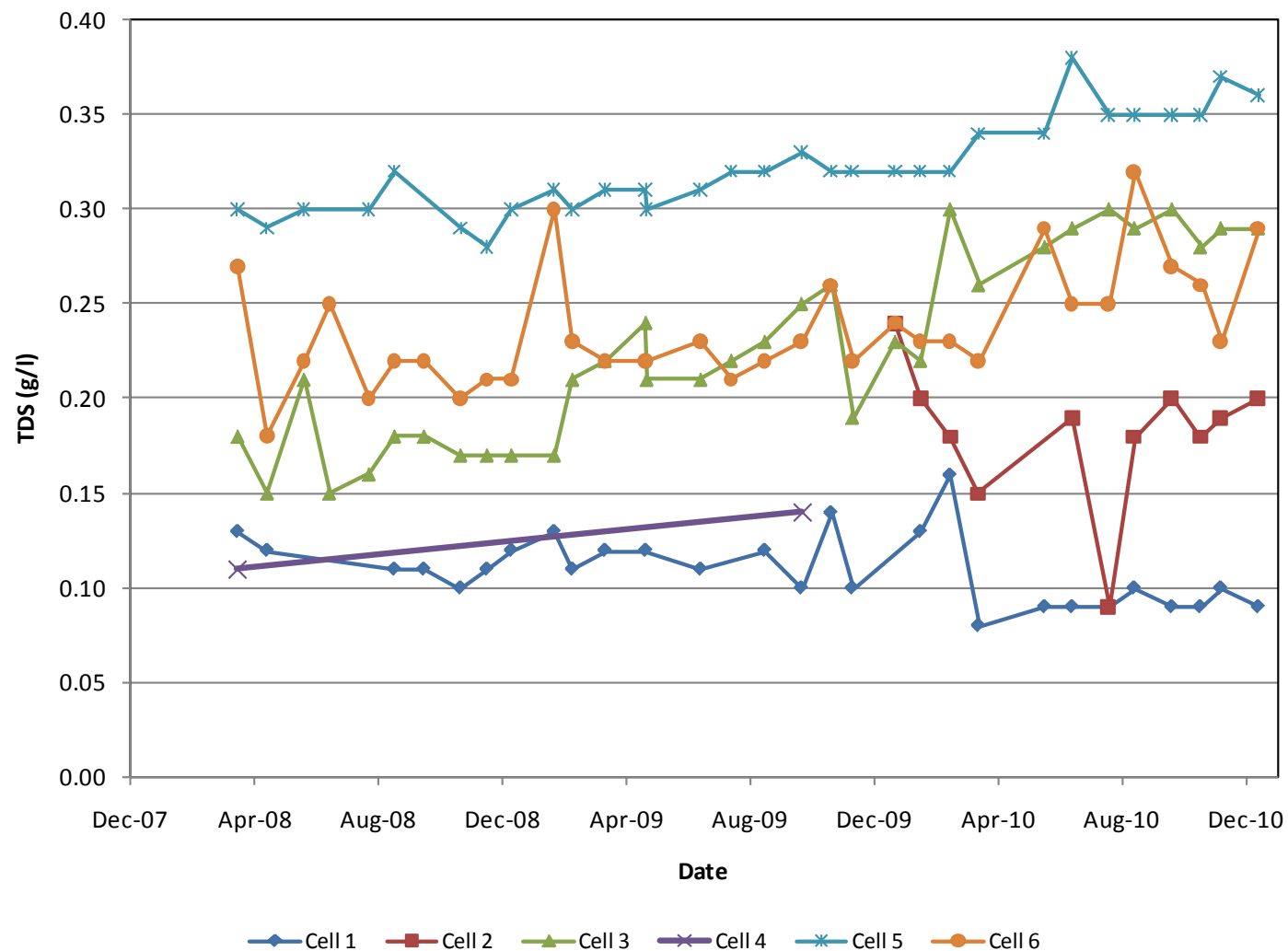


Figure 4-5 – Total Dissolved Solids of Cells 1-6 in Leak Detection Zone

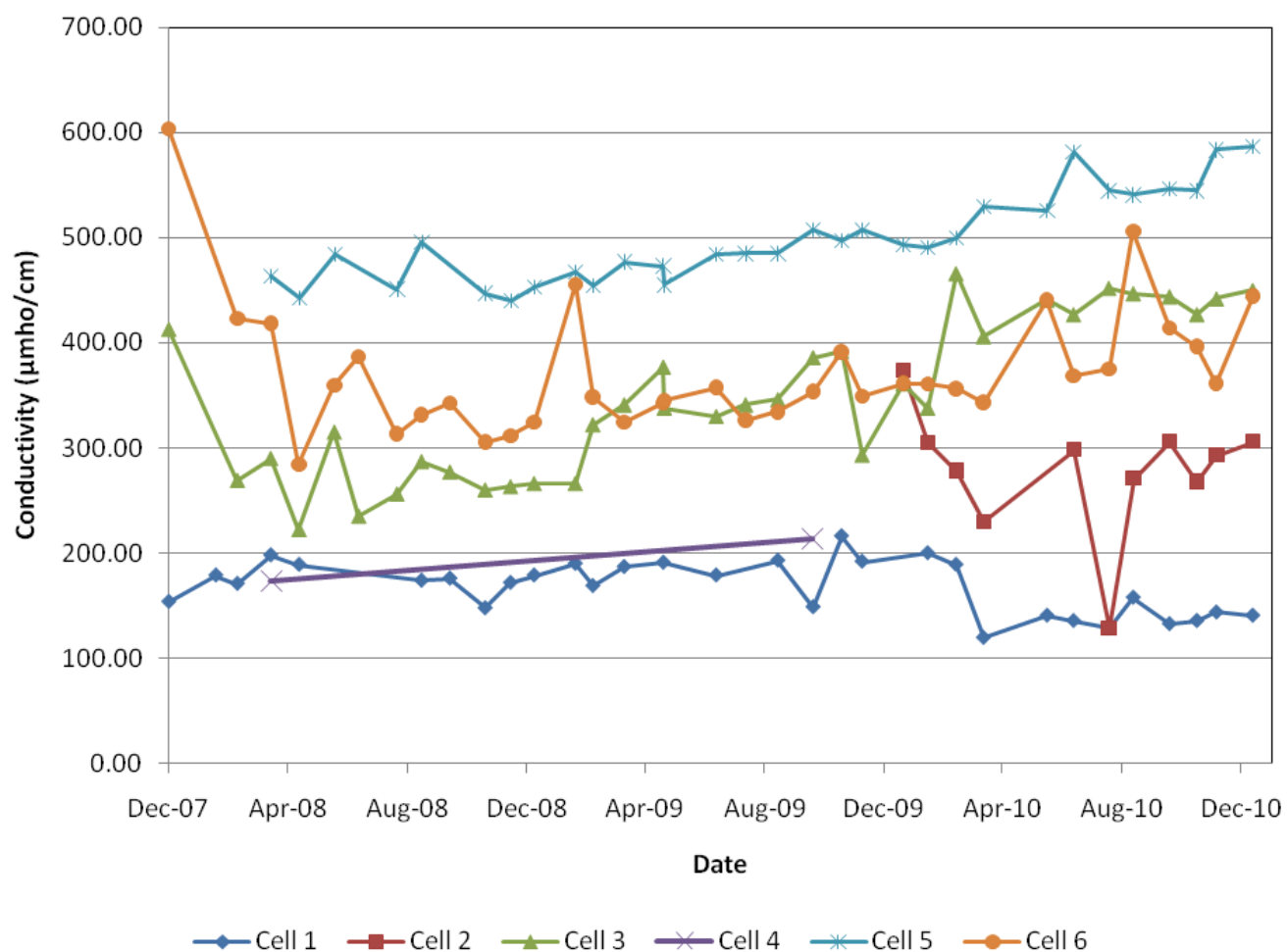


Figure 4-6 – Specific Conductance of Cells 1-6 in Leak Detection Zone

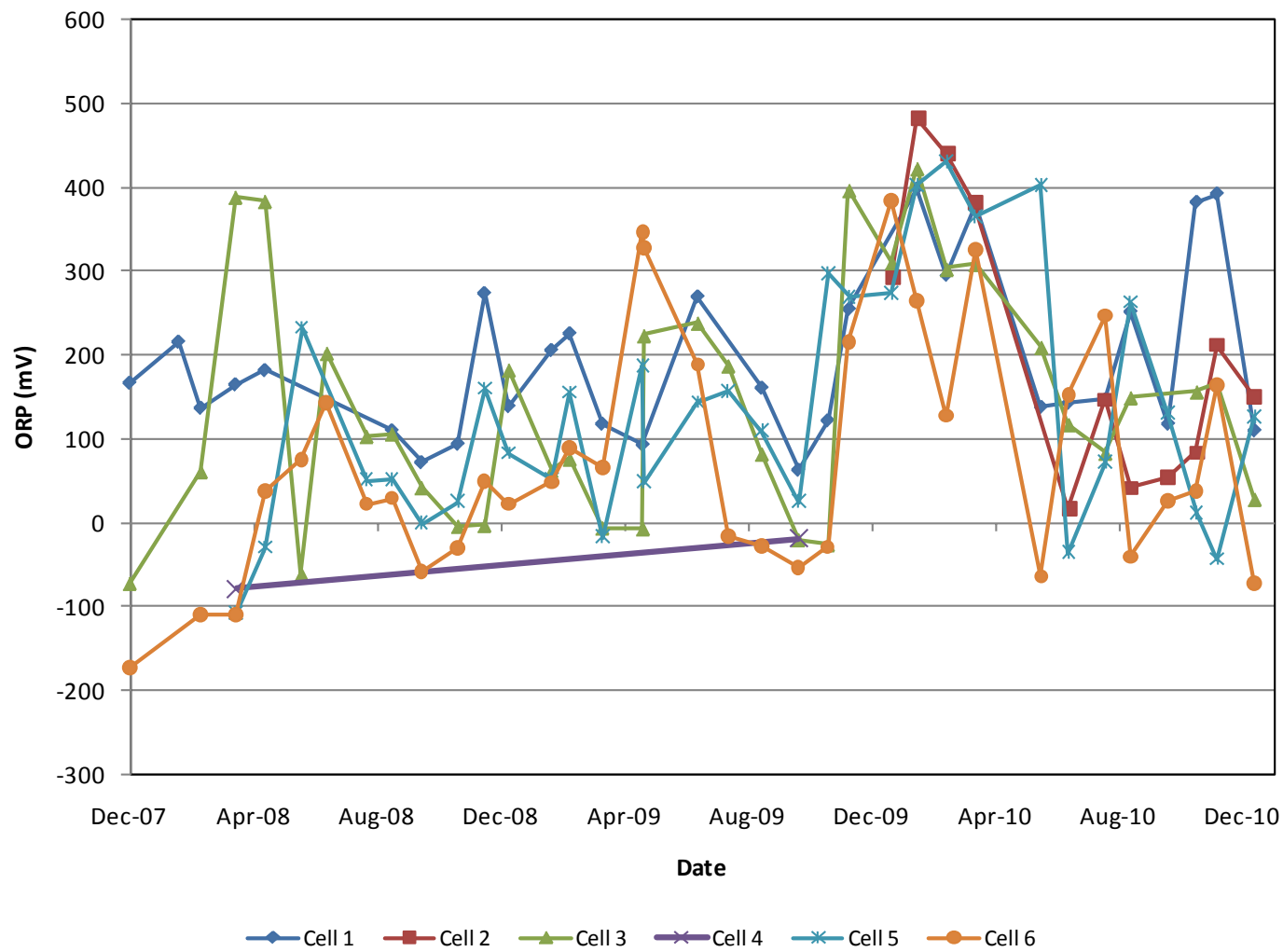


Figure 4-7 – Oxidation Reduction Potential of Cells 1-6 in Leak Detection Zone



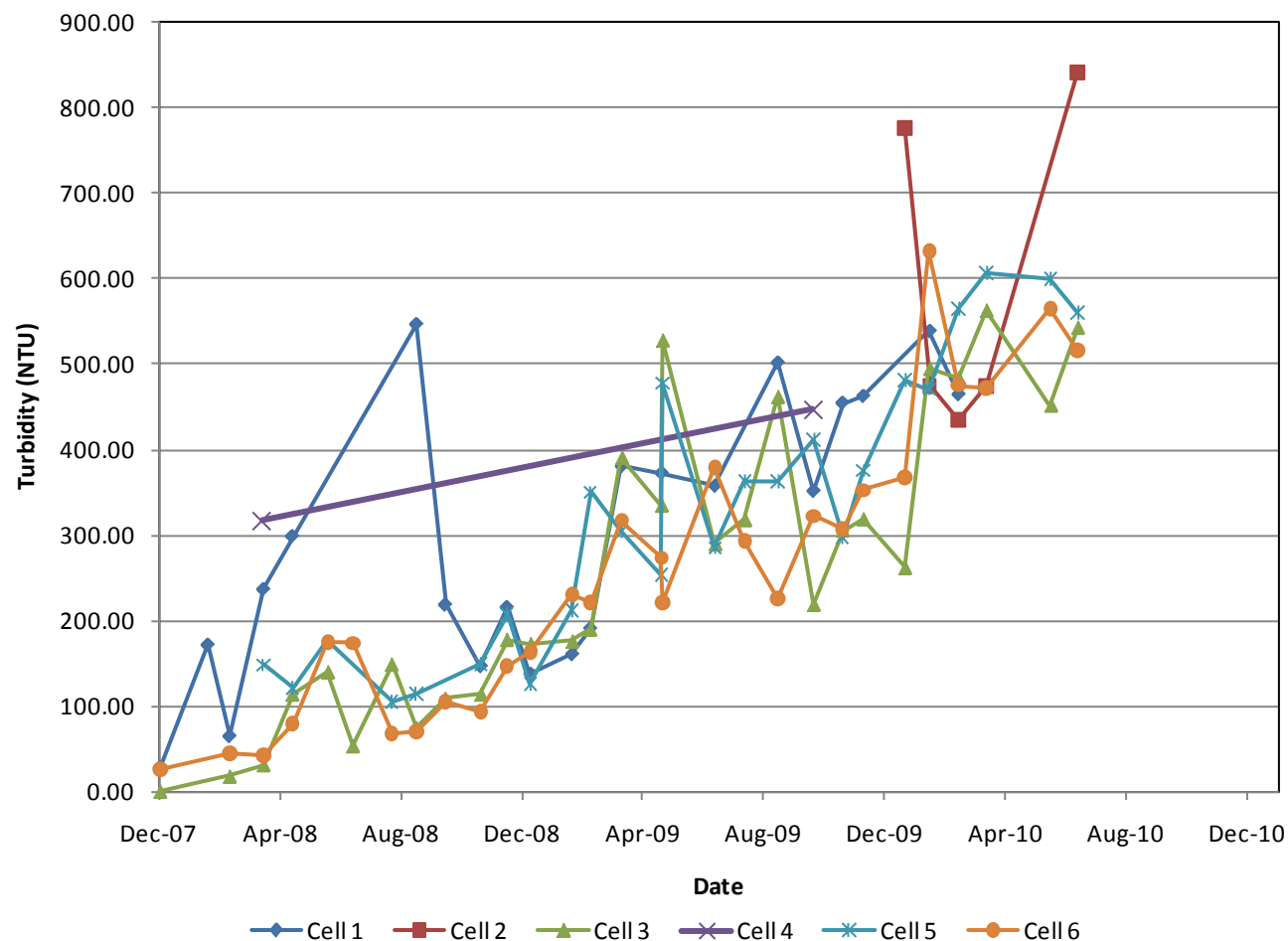


Figure 4-8 – Turbidity of Cells 1-6 in Leak Detection Zone

## 4.2 Leachate Collection System Quantity and Quality

Table 4-2 shows the annual quantity of leachate collected from the leachate collection system (LCS) of each cell. Leachate samples from Cells 1-6 and the leachate pond were analyzed for BOD, conductance, COD, ammonia, pH, temperature, ORP, TDS and turbidity as shown in Figures 4-9 through 17.

	Cell 1 (gallons)	Cell 2 (gallons)	Cell 3 (gallons)	Cell 4 (gallons)	Cell 5 (gallons)	Cell 6 (gallons)
	Subtitle D Liner		Alternative Liner			
Nov.-Dec. 2007	9,723	487	20,898	11,382	11,675	981,305
2008	288,526	8,860	94,705	173,647	164,467	8,904,461
2009	101,777	35,102	103,371	333,067	356,580	14,610,720
2010	173,878	34,813	283,867	419,454	124,089	7,097,590
Cumulative	573,904	79,262	502,841	937,550	656,811	31,594,076

Table 4-2 – Annual Leachate Collected from Cells 1-6

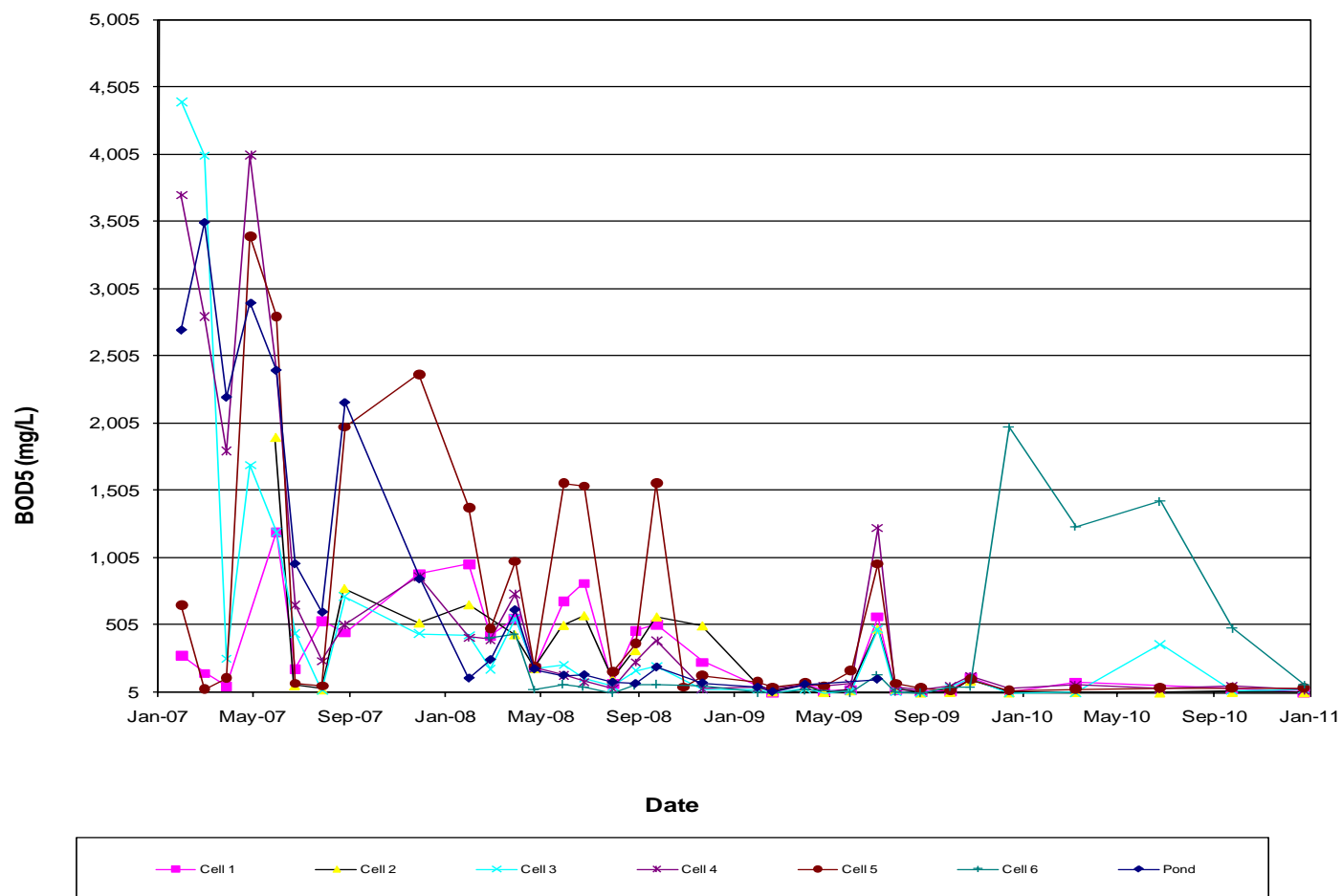


Figure 4-9 – BOD<sub>5</sub> of Leachate from Cells 1-6 and Pond

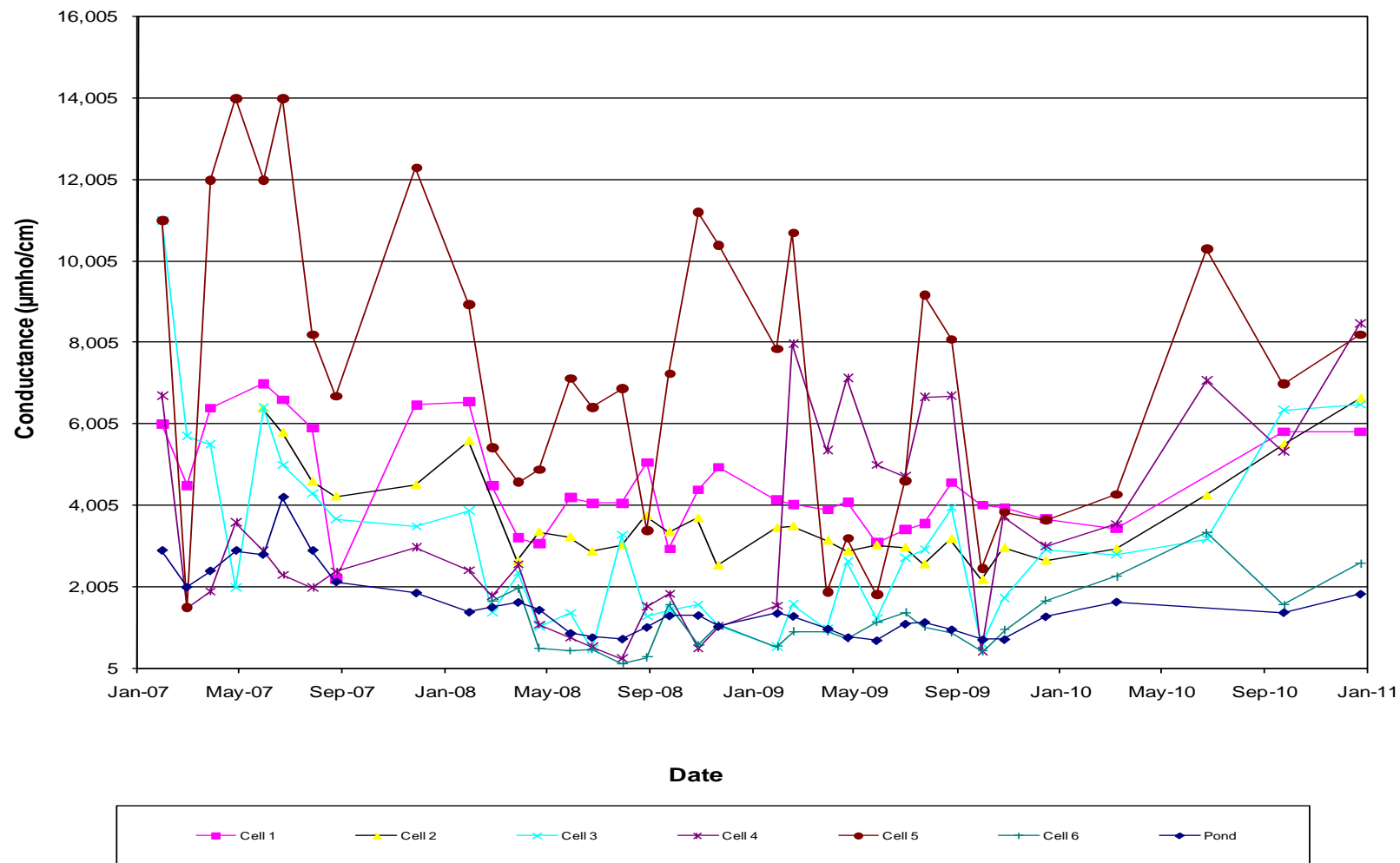


Figure 4-10 – Specific Conductance of Leachate from Cells 1-6 and Pond

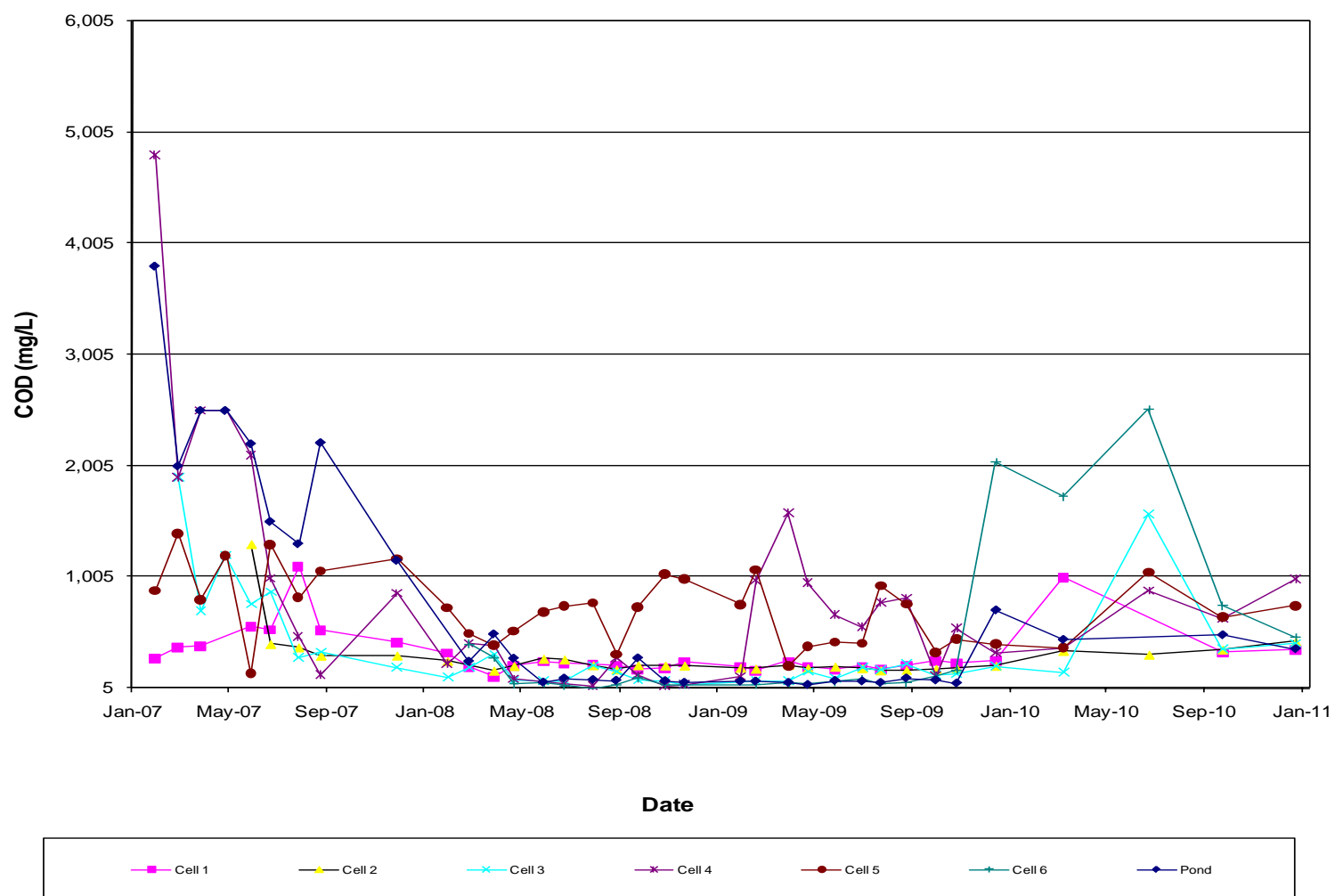


Figure 4-11 – COD of Leachate from Cells 1-6 and Pond

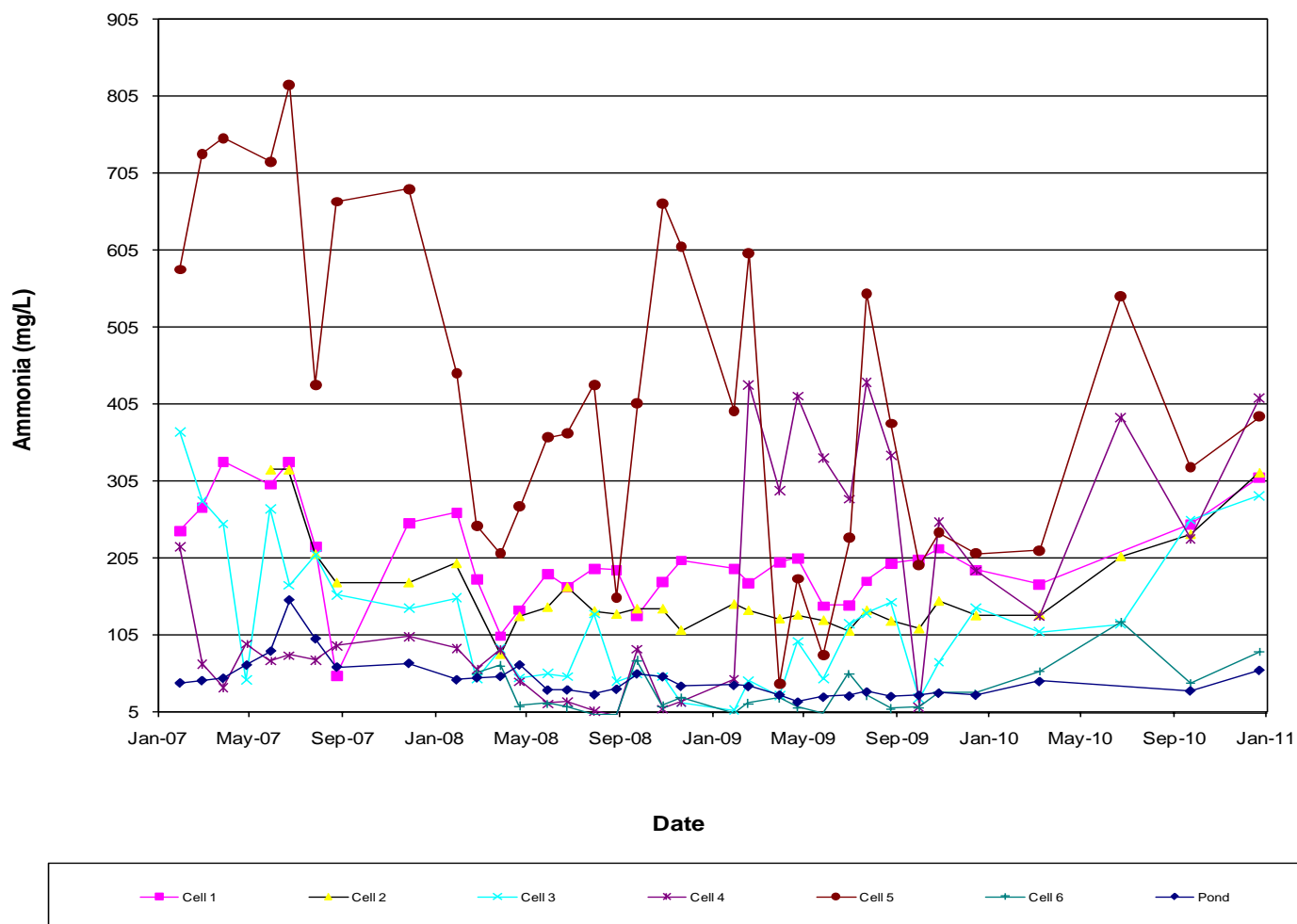


Figure 4-12 – Ammonia of Leachate from Cells 1-6 and Pond

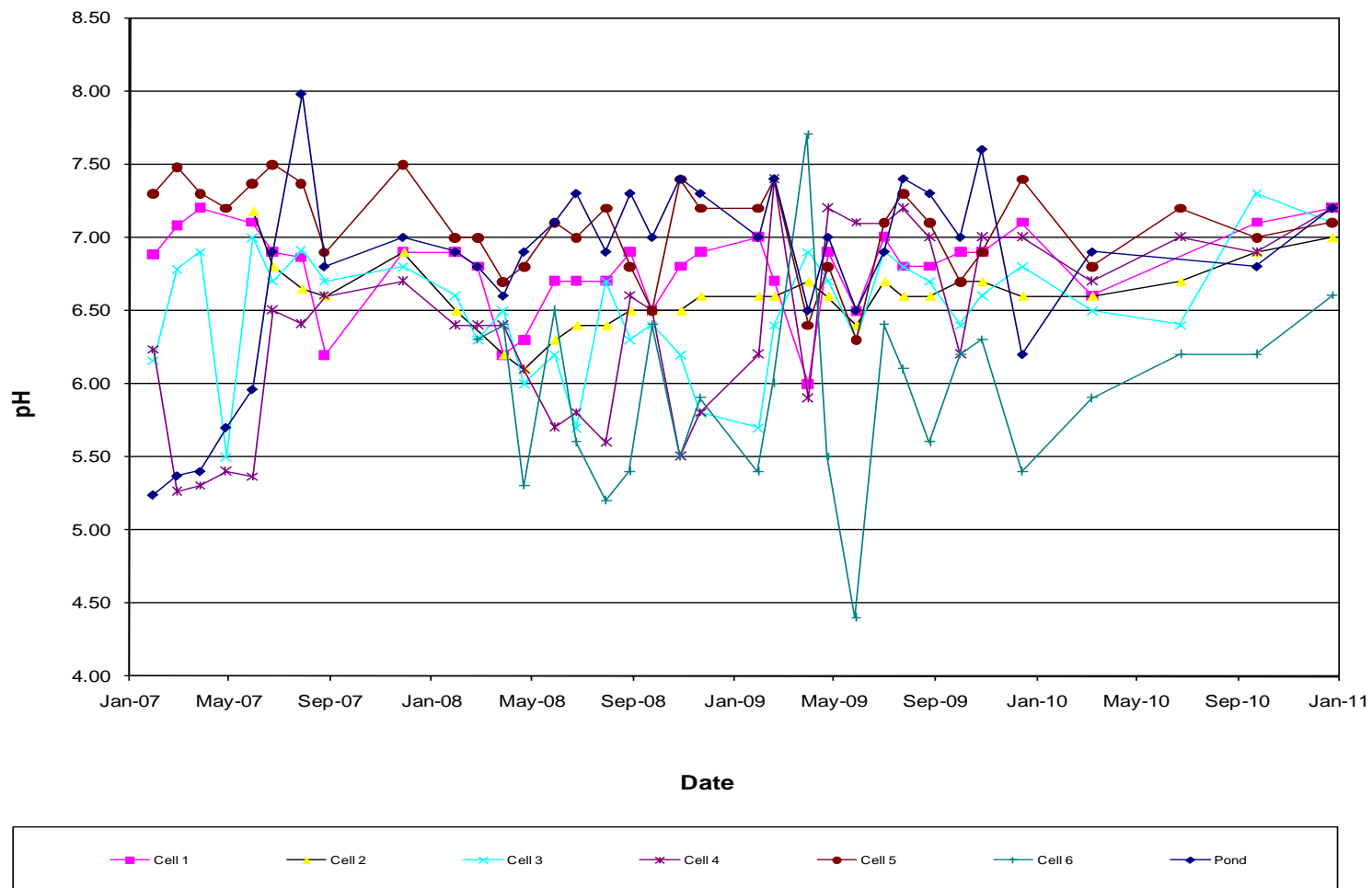


Figure 4-13 – pH of Leachate from Cells 1-6 and Pond

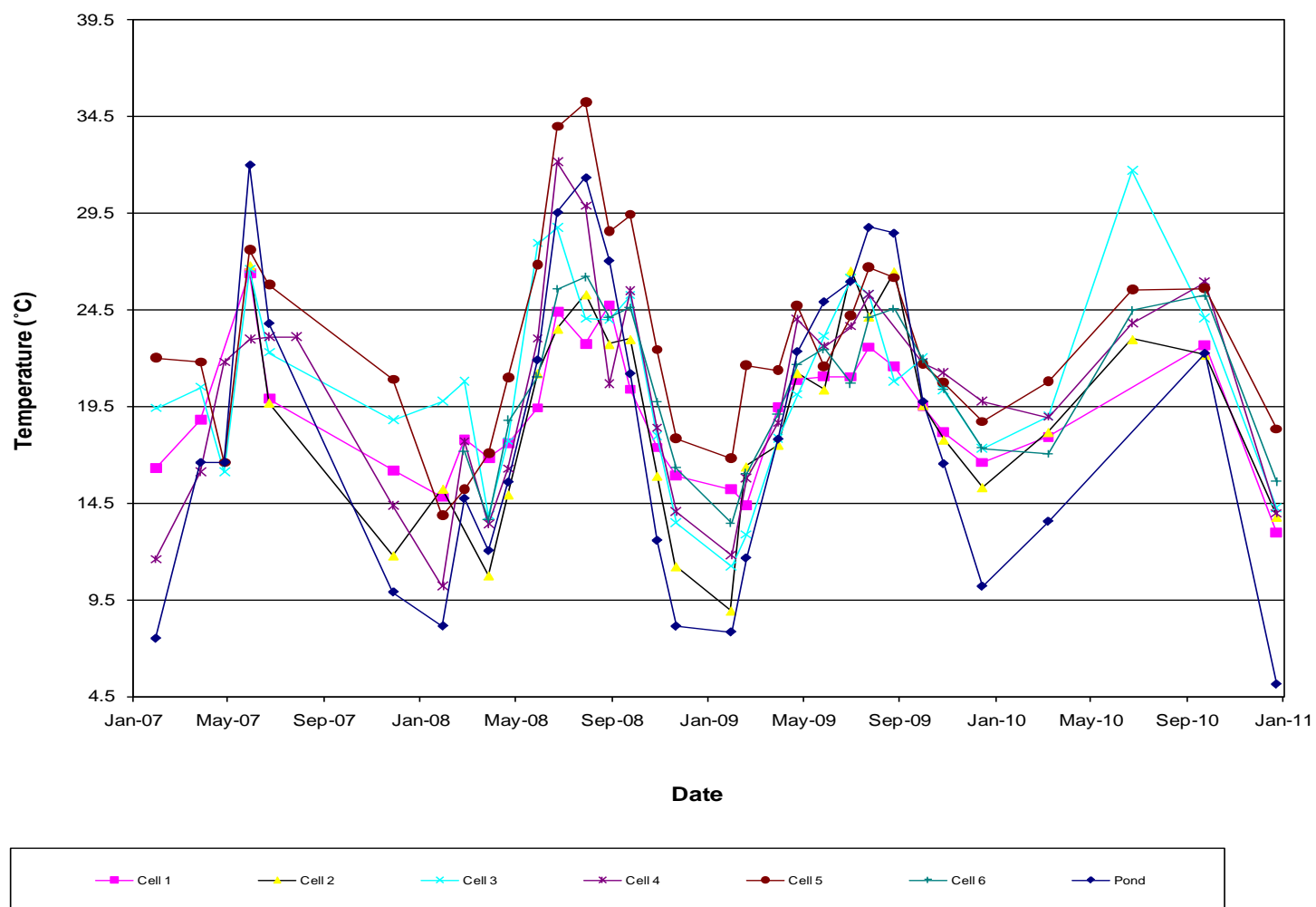


Figure 4-14 – Temperature of Leachate from Cells 1-6 and Pond



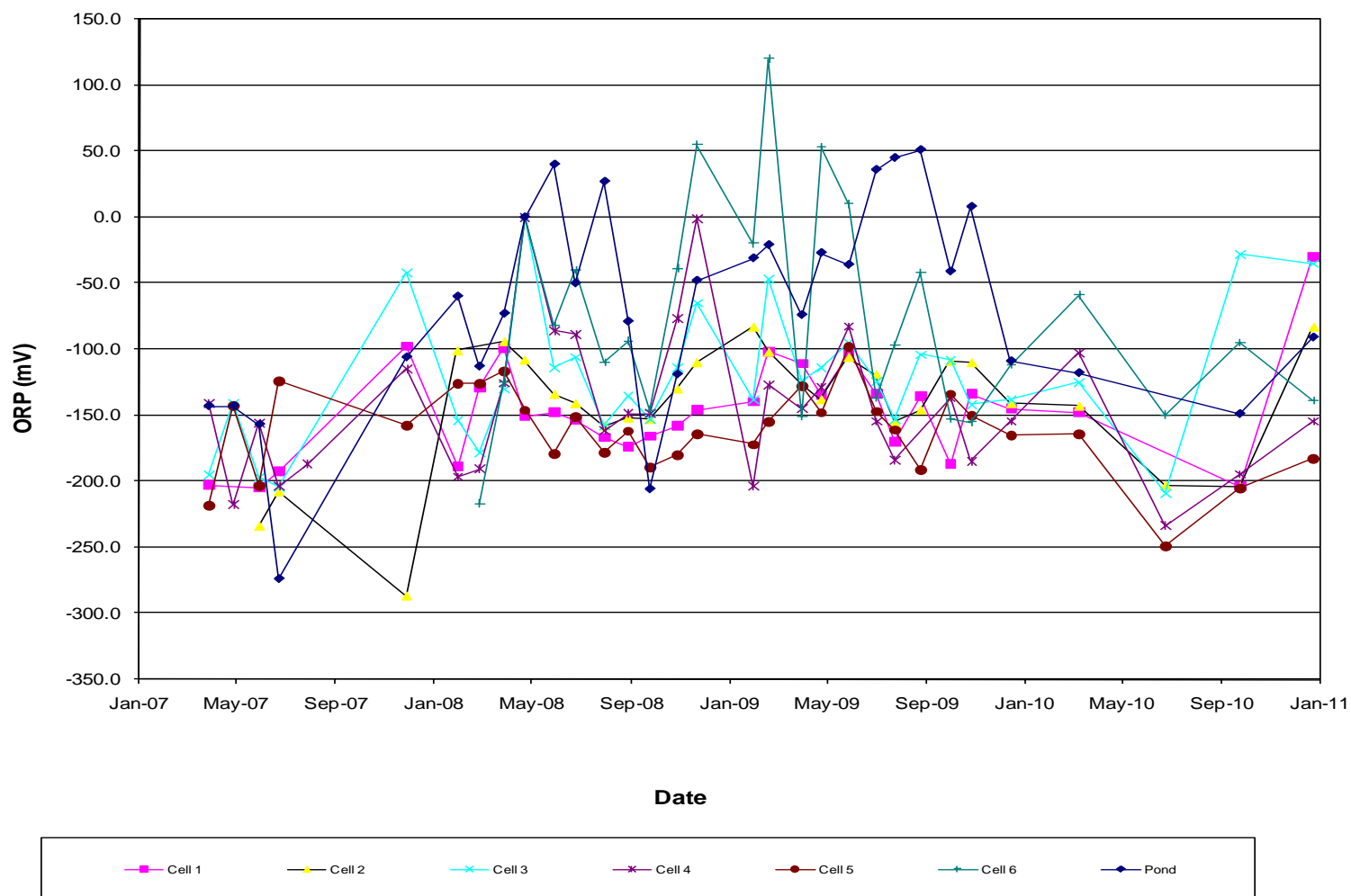


Figure 4-15 – ORP of Leachate from Cells 1-6 and Pond

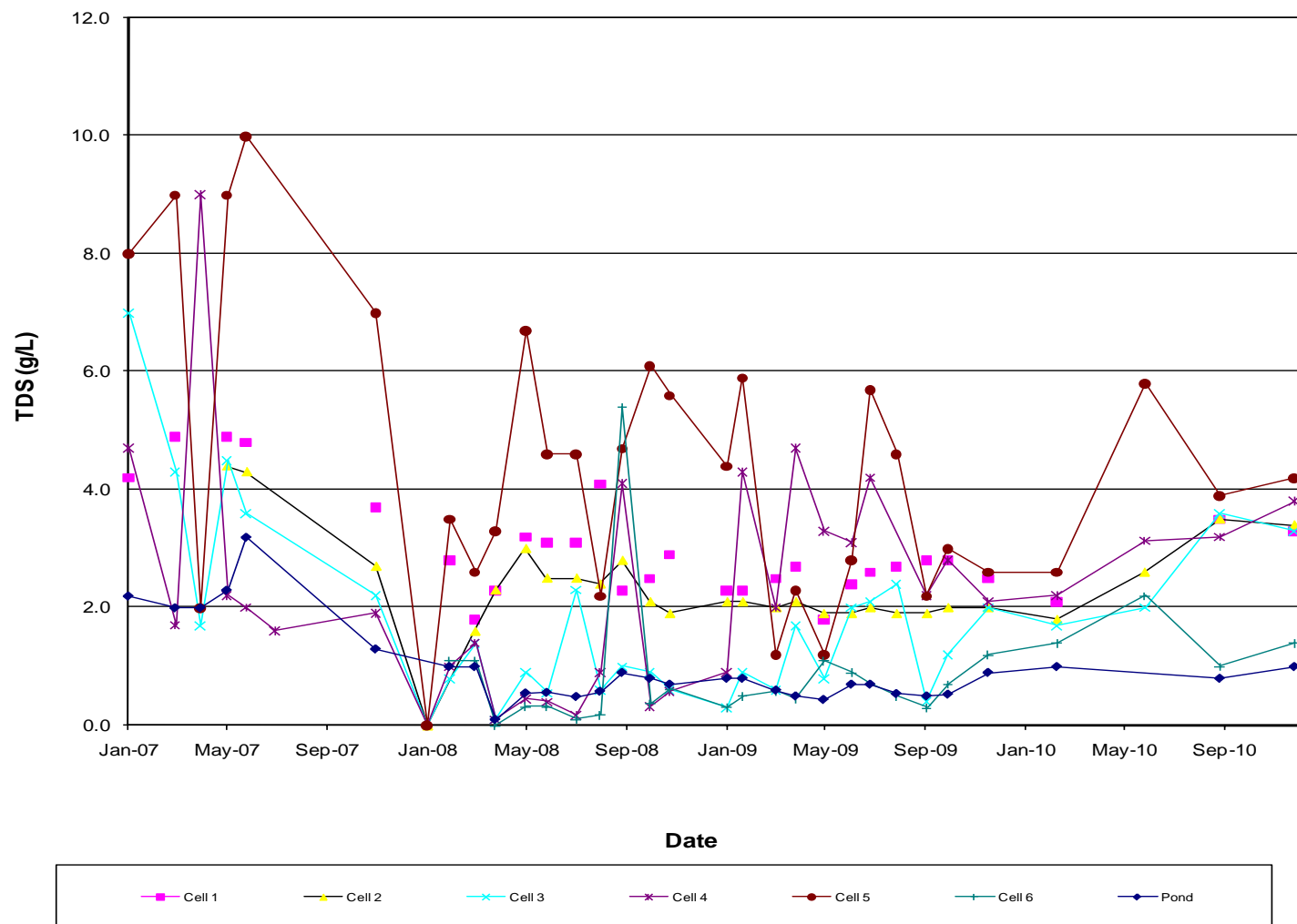


Figure 4-16 – TDS of Leachate from Cells 1-6 and Pond

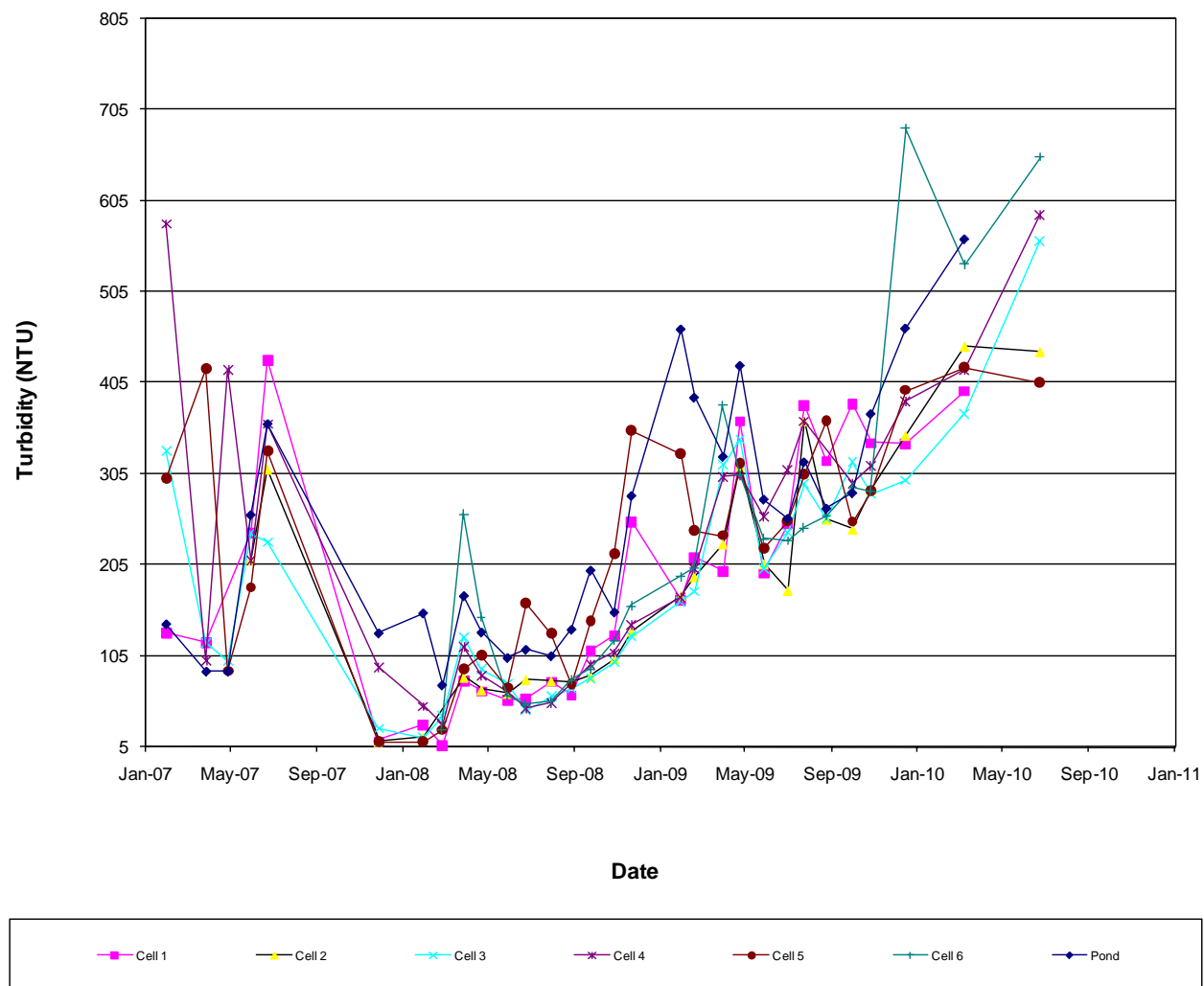


Figure 4-17 – Turbidity of Leachate from Cells 1-6 and Pond

### 4.3 Leachate Recirculation Quantity

Figure 4-18 shows the cumulative quantity of leachate recirculated in the Phase 1 Retrofit System area from 2006 until 2010. Approximately 1.6 million gallons of leachate has been recirculated. The annual leachate recirculated in HITs and SGTs are presented in Table 4-3.

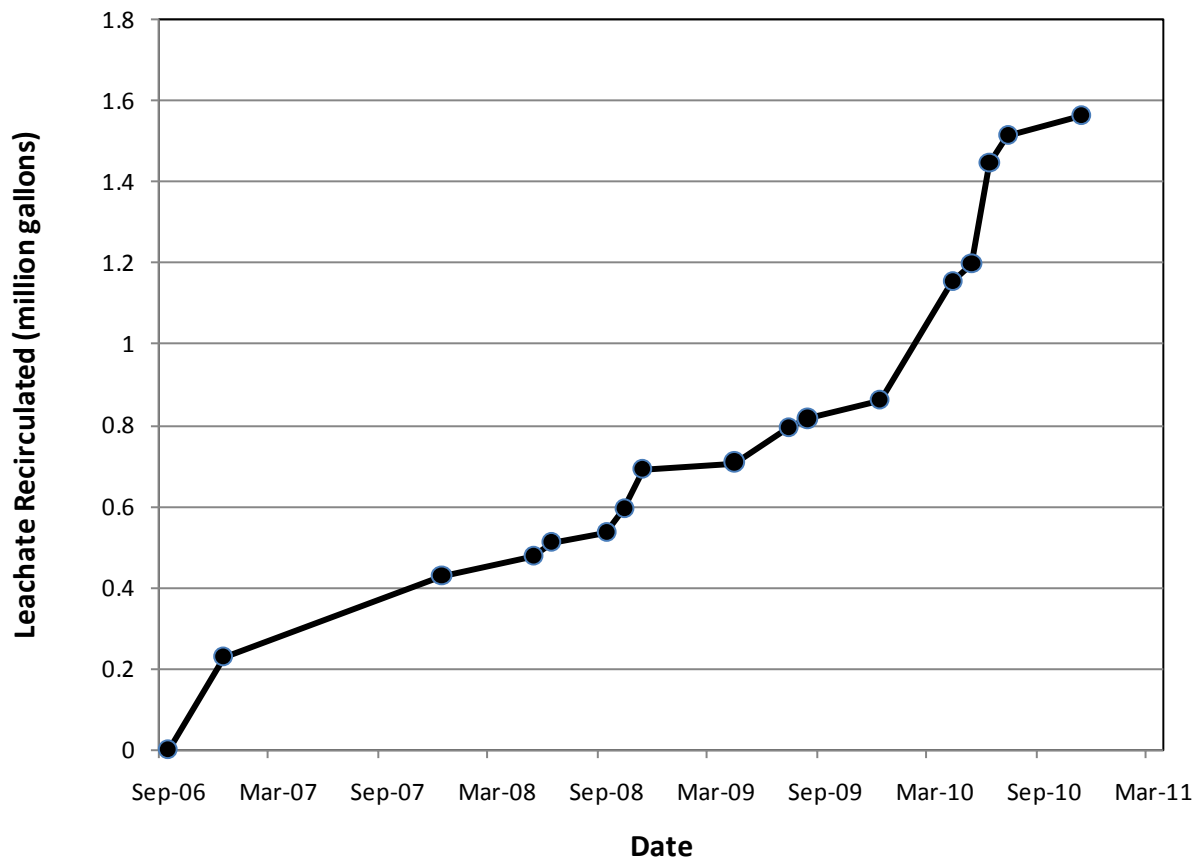


Figure 4-18 – Cumulative Volume of Leachate Recirculated

Date	HITs D, E, and F (gal)	SGTs 1A, B, and C (gal)	SGTs 2A, B, and C (gal)	SGTs 3A, B, and C (gal)	HITs A, B, and C (gal)	SGTs 4A and 4B (gal)	SGTs 5B and 5B (gal)	Volume Recirculated (Gallons)
2006	32,093	48,140	48,140	48,140	32,093	10,698	10,698	230,000
2007	27,907	41,860	41,860	41,860	27,907	9,302	9,302	200,000
2008	116,108	45,191	42,883	35,985	14,720	-	-	254,887
2009	48,210	3,670	1,720	3,590	105,330	8,510	-	171,030
2010	296,600	20,000	24,100	21,300	307,733	21,667	10,000	701,400

Table 4-3 – Annual Leachate Recirculation Volumes

#### 4.4 Gas Quantity and Quality

Figure 4-19 presents the total gas flow measurements taken at the flare station. The flow rate readings varied from 200-550 scfm. The flare station has been shut down for most of the time due to an insufficient amount of gas to operate the flare. More gas wells are currently being installed and will be operational in mid-2011. Figure 4-20 presents the average landfill gas composition as measured at the flare in 2008.

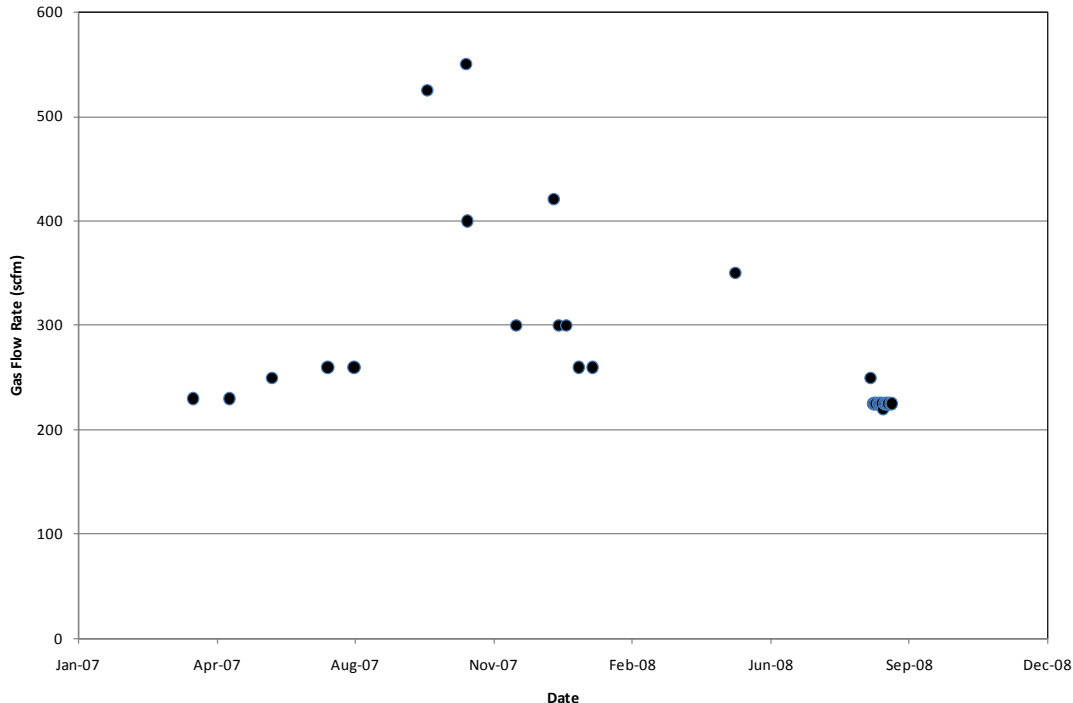


Figure 4-19 – Total Gas Flow Measured at the Flare Station

## Landfill gas quality

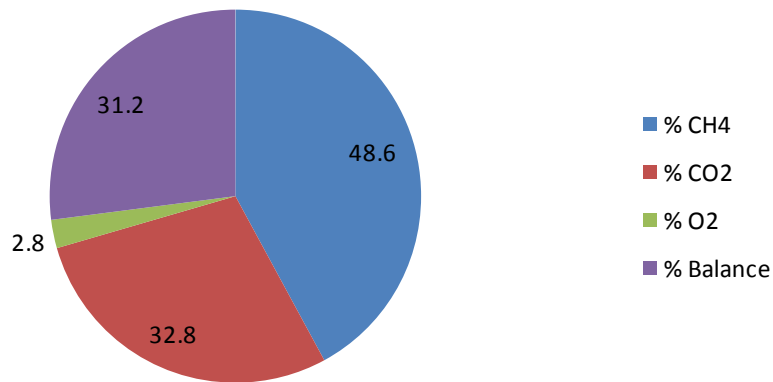


Figure 4-20 – Typical Landfill Gas Composition

### 4.5 Settlement

Figure 3-1 shows the location of settlement plates installed at the surface of the landfill. Figure 4-21 compares the measured settlement from July 2006 until November 2010.

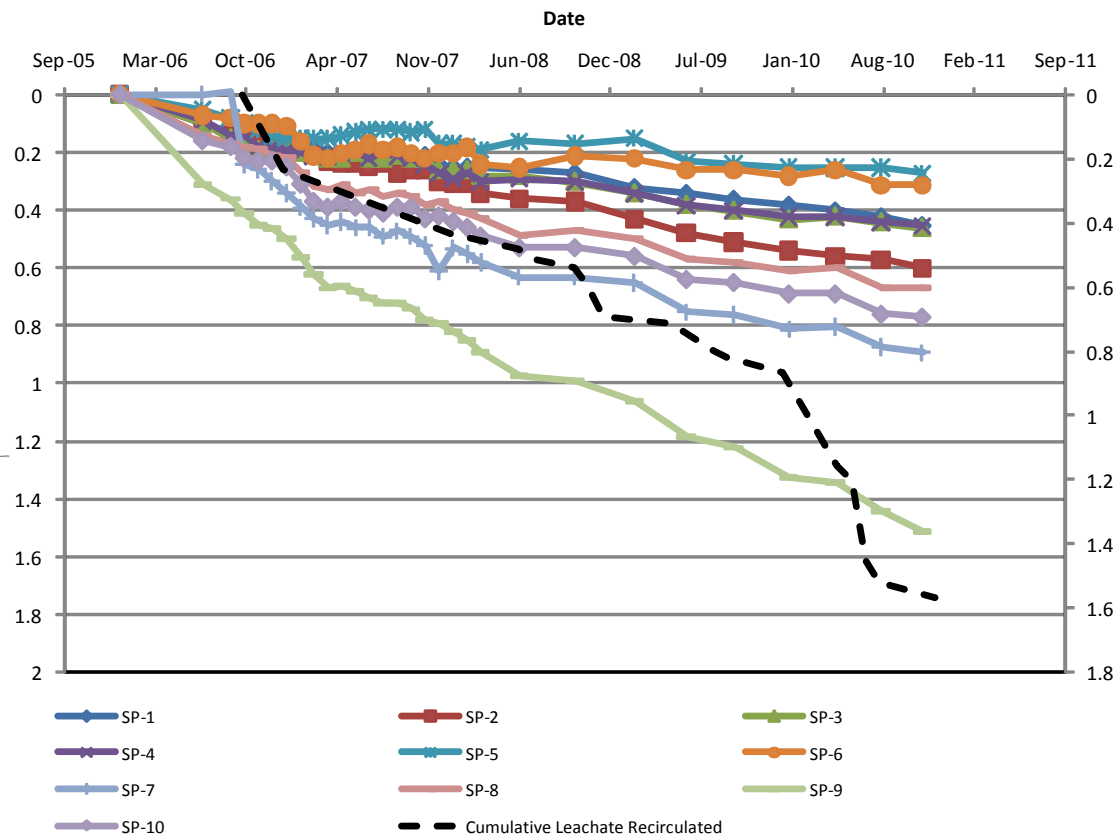


Figure 4-21 – Cumulative Settlement

## Section 5

### Project Assessment

## 5.0 Project Assessment

### 5.1 Determination of Liquid Sources in the LDZ

It cannot be assumed that liquid in the LDZ is necessarily leachate leaking through the base liner system of a cell. As shown in Figure 5-1, the LDZ are open on the sides and therefore are subject to potential groundwater infiltration. This is particularly evident in Cell 1 where it is probable that the LDZ is being fed by groundwater based on the large amount of flow witnessed during sampling events and the results of the quality testing. Comparison of testing data between the LDZ, leachate and groundwater was performed in an effort to determine the source of the liquid in the LDZ.

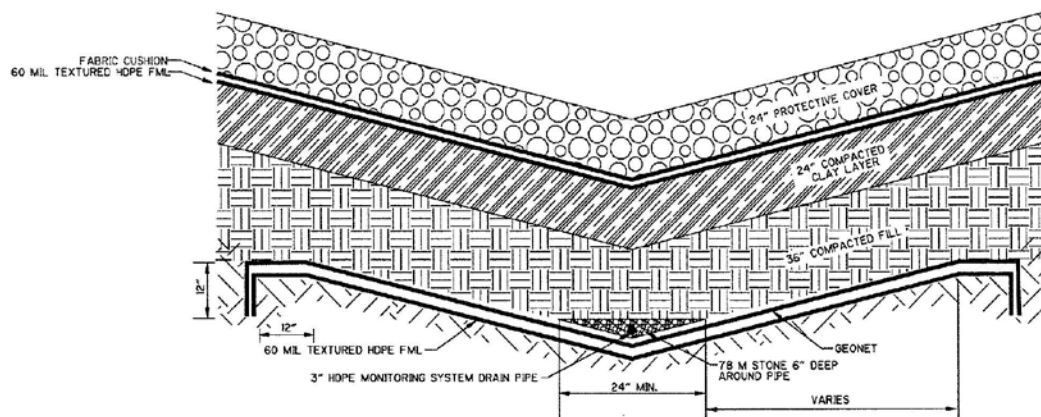


Figure 5-1 – Leak Detection Zone in Cells 1-6 and Leachate Pond

In comparing test data it was found that the conductance levels of leachate trend much higher than those for the LDZ and groundwater well samples. The conductance of leachate is in the range of 800-1,800  $\mu\text{mho}/\text{cm}$  compared to 200-550  $\mu\text{mho}/\text{cm}$  for the LDZ and groundwater well samples (Refer to Figure 5-2).

Toluene, which is a commonly present in leachate, was not detected in any of the LDZ or groundwater samples as shown in Figure 5-3.



Figure 5-4 shows the ORP values for the leachate and LDZ samples for all cells. Comparison of ORP values also shows a strong distinction between leachate and the liquid sampled from the LDZ. The ORP values for leachate are all negative while all but one of the LDZ samples produced positive values. A negative value is indicative of anaerobic conditions as would be expected for landfill leachate. Thus, the positive readings for the LDZ samples indicate that it is not leachate.

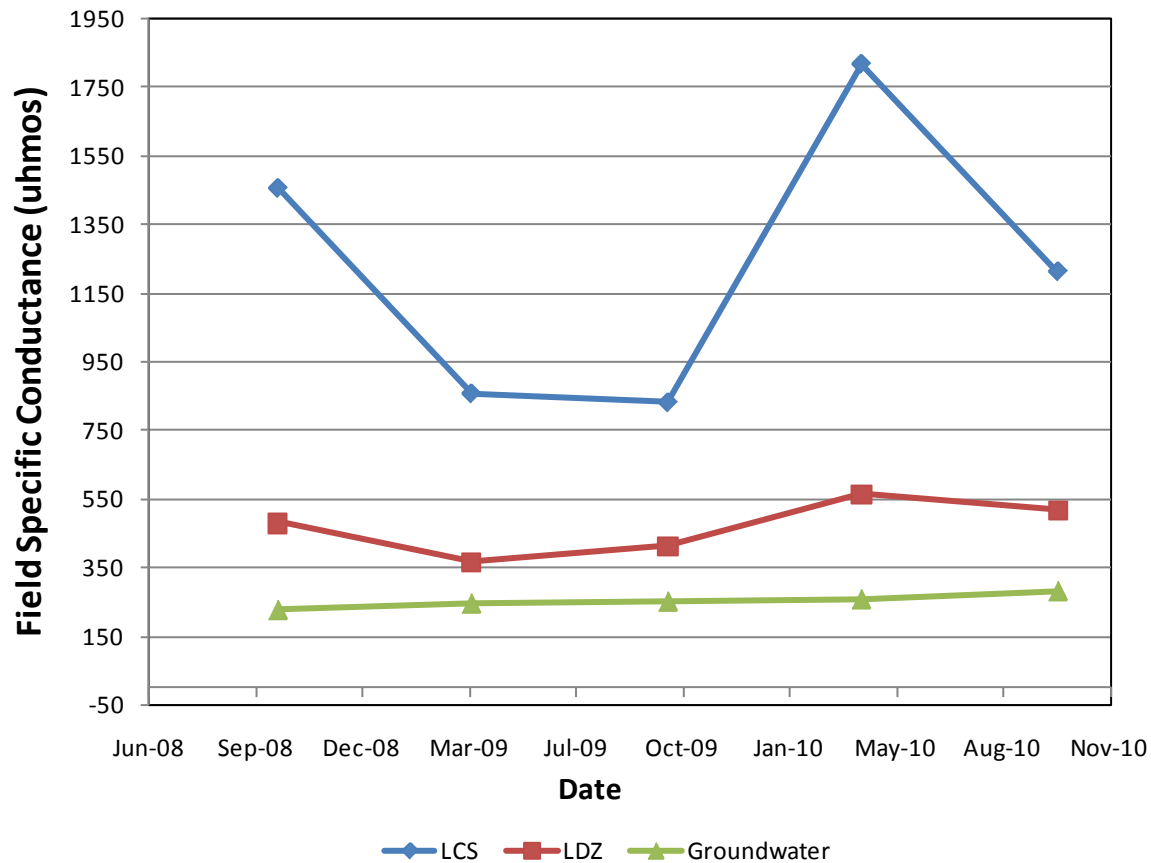


Figure 5-2 – Conductance of LCS, LDZ, and GW Samples  
(Values are averages of testing results for the six cells and all GW monitoring wells)

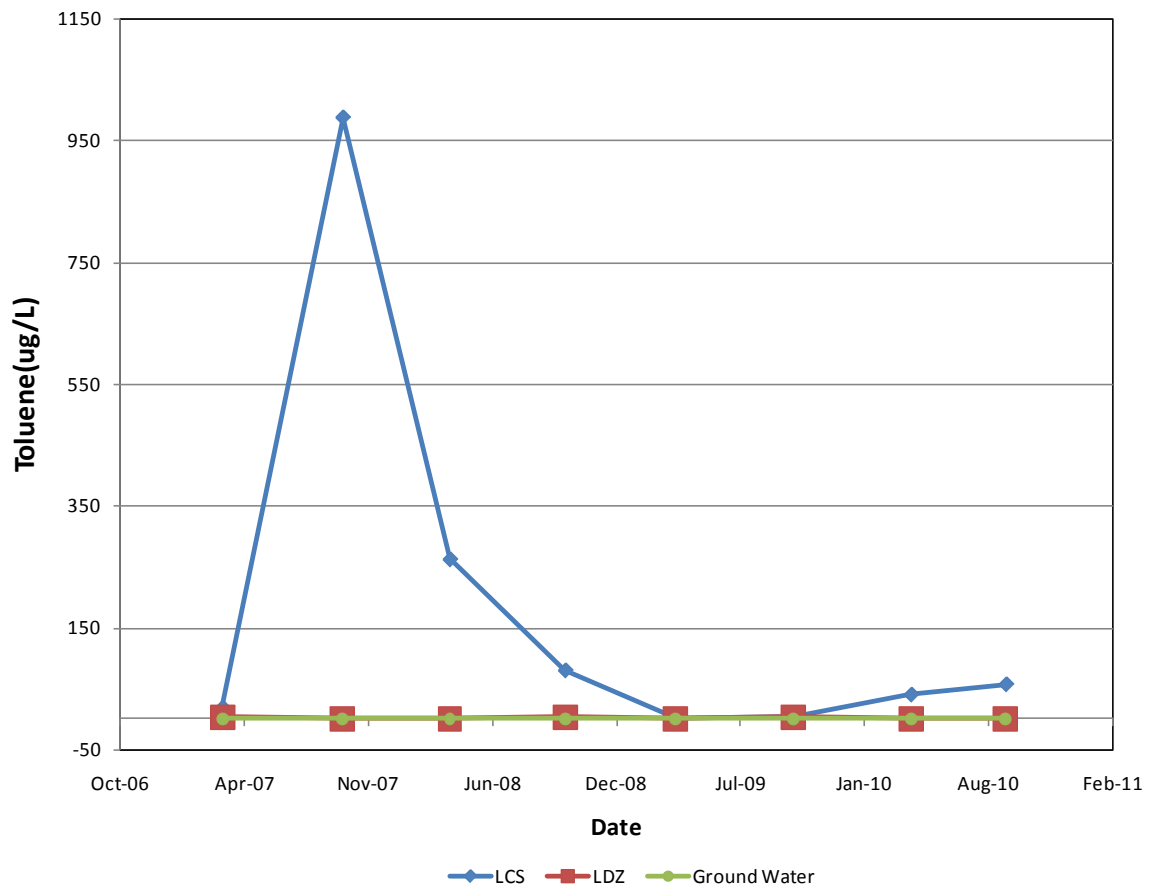


Figure 5-3 – Toluene of LCS, LDZ and GW Samples  
(Values are averages of testing results for the six cells and all GW monitoring wells)

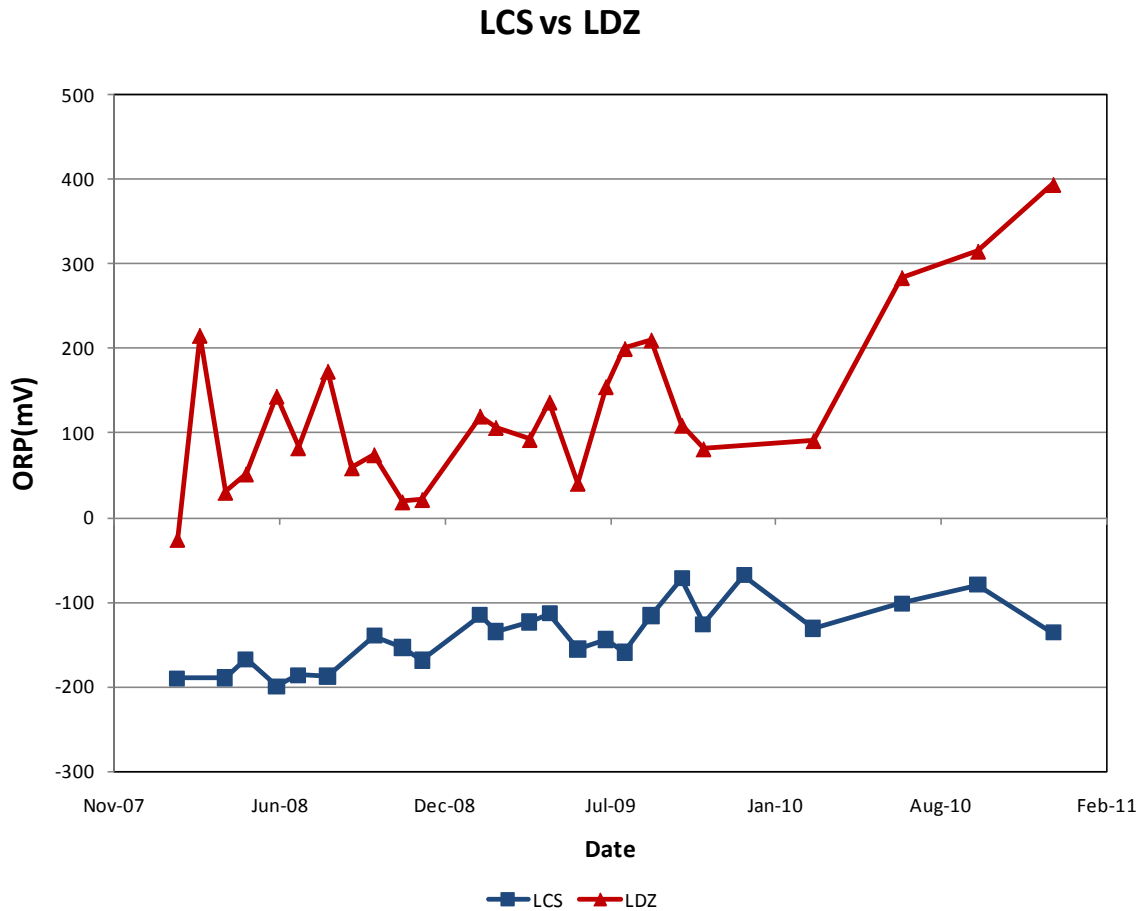


Figure 5-4 – ORP of LCS and LDZ  
(Values are averages of testing results for the six cells)

Based on these comparisons it appears that the liquid in the LDZ consists primarily of groundwater. As no appreciable amount of leachate has been detected in any of the LDZ to date this indicates that both types of liner systems are currently performing adequately and are not experiencing negative impacts from the leachate recirculation program.

## 5.2 Reduction of Leachate Hauling and Treatment at the Wastewater Treatment Facility

Nearly 1.6 million gallons of leachate has been recirculated since the start of the bioreactor program in 2006 resulting in 320 less truck trips to the wastewater treatment plant (WWTP). To date the County has saved approximately \$78,000 in avoided hauling and treatment costs. With the planned expansion of the bioreactor system into Cell 6, the largest cell of the landfill, the amount of leachate that can be recirculated will be significantly increased. It is anticipated that hauling of leachate will cease once the Cell 6 HIT are operational.

### 5.3 Waste Stabilization

Twenty five vertical wells were installed in Cells 1-5 in November 2010 for the landfill gas-to-energy project. Photographs were taken of the exhumed waste to observe the degree of stabilization as shown in Figure 5-5 and 5-6. Waste temperatures were taken immediately after waste was extracted from the boreholes with an infrared thermometer. Most locations showed waste temperatures in the mid-90's with the exception of the following five wells which showed elevated temperatures:

- VW-6: 100 deg F
- VW-24: 110 -130 deg F
- VW-10: 104 -108 deg F
- VW-18: 110 deg F
- VW-11: 105 -108 deg F

The waste from these five boreholes was observed to be noticeably wetter than the waste for the other boreholes. Steam emanating from the waste of VW-24 was indicative of the elevated temperatures. The waste from this borehole appeared to be well decomposed.



Figure 5-5 – Exhumed Waste from Drilling of Vertical Well 24



Figure 5-6 – Exhumed Waste from Drilling of Vertical Well 13

The BOD<sub>5</sub>/COD ratio of the landfill leachate has dropped steadily since 2007 indicating that stabilization of the organic waste fraction is occurring as shown in Figure 5-7.

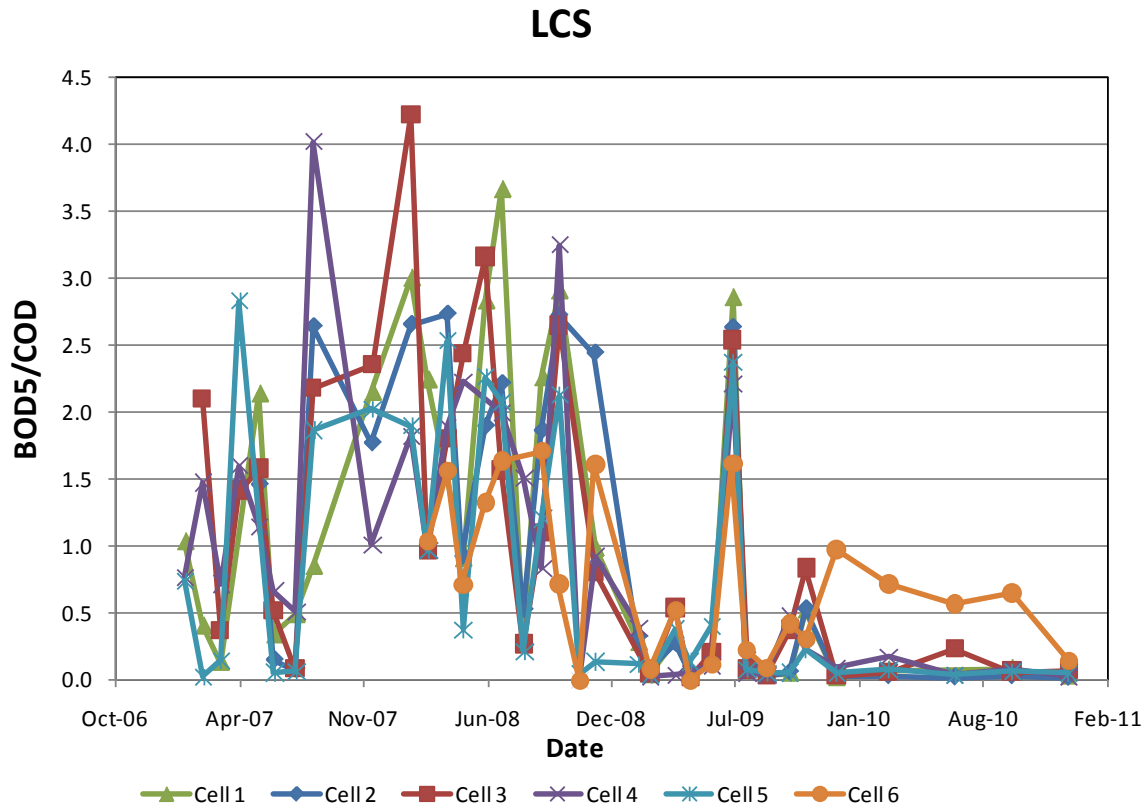


Figure 5-7 – BOD<sub>5</sub>/COD Ratio of LCS in Cells 1-6



## Section 6

# Recommendations

### 6.0 Recommendations

#### 6.1 Recommended Modifications to the Monitoring Program

##### 6.1.1 Turbidity and DO Testing

Testing of these parameters has been problematic due to difficulties in obtaining samples that are not impacted by sediment buildup in the sumps and oxygenation resulting from pumping. As these parameters are not considered to be particularly important to the study (i.e.; these parameters were selected based on the capabilities of the Horiba unit) it is recommended that they be omitted from future testing.

##### 6.1.2 Sampling Frequency and Testing Methods for LDZ Liquids

To date samples from the LDZ have been tested monthly. It is recommended to reduce the testing frequency to quarterly to correspond with testing of the LCS as it has been determined that monthly testing is no longer required based on the consistency of the data. In addition, it is recommended that the testing parameters be changed to match the LCS testing parameters which include laboratory testing of BOD<sub>5</sub>, pH, COD, ammonia, and specific conductance and onsite analysis of temperature and dissolved oxygen.

##### 6.1.3 Measuring Flow Rates from Cells 1 and 2 LDZ

To date, quantity measurements have not been performed on the Cells 1 and 2 LDZ due to the inability to access the discharge points with the vacuum pump truck. It is recommended that alternative means of measuring quantity be employed going forward. A bucket of known volume could be placed at the end of the discharge pipe and the sampler could record the amount of time it takes to fill the bucket to calculate a flow rate. Then the sampler could record the amount of time from start of flow to end of flow to calculate an approximate quantity.

##### 6.1.4 Measuring Settlement

In addition to measuring the settlement plates we recommend performing annual topographic surveys and calculating airspace gain due to settlement. Also, show the specific areas of settlement using AutoCAD by notating elevation differences on a prescribed grid (i.e.; 50-ft grid).

### 6.1.5 LFG Monitoring

Extensive gas data can be collected once the landfill gas-to-energy facility is functional. A gas monitoring system and a flow meter has been installed at the flare station, and the data will be collected using a supervisory control and data acquisition (SCADA) system. This information will be incorporated into the bioreactor monitoring program.

### 6.1.6 Insitu Temperature Monitoring

Use thermistor sensors in the waste to track the extent and rate of wetting from the HIT by monitoring temperature drop attributed to recirculated leachate. This could be added to the HIT for the Cell 6 installation. Monitoring temperature will also allow the operator to experiment with recirculation of leachate in the winter months. Currently, recirculation is not performed when the leachate in the pond is below 50 degrees F.

## 6.2 Recommended Modifications to Design and Operation

### 6.2.1 Leak Detection Zones

For Cells 7-10, it is recommended that the design of the LDZ be revised to eliminate the 3-foot separation between the LDZ and the bottom of the base liner system as this will greatly reduce the potential for groundwater infiltration.

### 6.2.2 Leachate Recirculation Quantities

After the installation of the first tier of HIT in Cell 6 it is recommended that the majority of leachate recirculation be performed in Cell 6 with limited leachate recirculation in Cells 1-5. This will allow the operator to carefully observe the impact of wetting on the new gas collection wells in Cells 1-5 without threat of flooding out the wells.

### 6.2.3 Alternative Cover Material

Posi-shell has been approved by the North Carolina Department of Environment and Natural Resources for use at the Buncombe County landfill. The use of alternative daily cover improves distribution of wetting from the HIT, uses less airspace than soil, and allows the onsite borrow soils to be saved for new cell and capping construction. We recommend that alternative cover material be used to the largest extent possible in the ongoing landfill operation.



# Appendix A

# **USEPA PROJECT XL FINAL PROJECT AGREEMENT**

**Leachate Recirculation/Gas Recovery (“Bioreactor”) Project**

**Buncombe County Solid Waste Management Facility  
Alexander, North Carolina**

September 18, 2000

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## **I. Introduction to the Agreement**

### **A. Description of the Project and Its Purpose**

Under this proposed XL Project, Buncombe County, North Carolina proposes to construct the necessary infrastructure and operate a combined leachate recirculation and gas recovery system (commonly referred to as a "bioreactor" system) at its Subtitle D landfill. Research has shown that there are numerous environmental benefits that can result from operating a sanitary landfill in such a manner. The primary goal of this project will be to demonstrate that leachate can be safely recirculated over an alternate liner system at a full-scale level (something that is not currently allowed under the Subtitle D landfill regulations, 40 CFR Part 258), and provide more data to substantiate the expected superior environmental and cost savings benefits. It is further hoped that data from this project can be used to support regulatory changes that will allow this type of project to be implemented at similar facilities across the country. It should be noted that, because the County will be making tremendous capital investments in facilities, it is requesting that it be allowed to expand the system to future cells assuming the project is successful and if enabling regulations are not promulgated in the meantime. This could potentially extend the term of the agreement to more than 25 years. Prior to implementation beyond cells 3, 4 and 5, the parties to the agreement will evaluate the progress to that point to determine whether or not to proceed with the remaining cells.

Buncombe County proposes an accelerated stabilization full-scale landfill pilot. The pilot would potentially encompass all 10 cells of the Buncombe County Municipal Solid Waste Management Facility. While other bioreactor studies have been conducted within this country and in Europe, many of those other bioreactor studies have been developed only at the bench scale or as pilot-scale studies which focused on a smaller, more controlled area. Buncombe County is seeking regulatory flexibility through Project XL. Project XL allows regulated entities to conduct pilot projects, within a specified scope, time, and on a site-specific basis to identify better ways to accomplish environmental benefits. The value in proposing the accelerated stabilization landfill at Buncombe is that it would provide superior environmental benefits (e.g., monitoring, gas collection, available data), in addition to cost savings to the County and the local residents.

First, one of the obvious differences between this pilot and other bioreactor landfills would be the scope of the experiment to be conducted. Buncombe proposes to conduct a large-scale (10 cell), fully controlled bioreactor landfill site. Buncombe County is the only known site to propose a full-scale pilot, in the true sense of the word. There is value in that alone. Second, the value in conducting a bioreactor pilot project at Buncombe County landfill in spite of other existing bioreactor experiments is because there are differences in the geographical context, and in State requirements for most projects. Third, another difference between the Buncombe site and others includes the proposed comparison between several existing and proposed cells on their own site. This comparison

would involve recirculating leachate and comparing Cell 1 and Cell 2 (composite liner), with Cells 3-10 (alternate, State-approved liner).

Buncombe County has developed their proposal for the bioreactor landfill based on the inclusion of all ten cells of the landfill. The infrastructure for the accelerated stabilization would require a substantial investment in the landfill of one million dollars. Buncombe County has conducted their research, has the necessary technical expertise to run such a bioreactor landfill, and is confident of the projected results. If the project were to be scaled-back to be less inclusive than the ten cells (e.g., cells 3-5), much of the cost effectiveness of the project would be lost.

Characteristics of waste streams change over time. As market preferences shift, and consumer interests change, the overall characteristics of waste going in to the landfill over time may change. By allowing a project that contemplates the life of the landfill (as opposed to a few cells) information concerning the behavior and effectiveness of bioreactors, EPA hopes to gain information about impact these types of changes have on the bioreactor.

EPA is also taking into account the long-term fiscal and physical planning necessary to optimally design and run a landfill. Viewing the whole landfill as a system, EPA has determined that this project provides an good opportunity to pilot the use of bioreactor technology over an alternative liner system. All other current safeguards and regulatory requirements that apply to bioreactors will remain in place.

#### Description of the Project Site:

The Buncombe County Solid Waste Management Facility was opened in September 1997. In addition to a Subtitle D landfill disposal area, the facility has a C&D landfill, a wood waste mulching facility, a convenience center for residential waste disposal and recycling, and drop-off areas for white goods and tires. The Subtitle D landfill disposal area comprises approximately 100 acres of the more than 600-acre site. The landfill has been designed with 10 separate disposal cells that will be constructed sequentially over the estimated 30-year life of the facility. Cells 1 and 2, which comprised Phase I of the landfill, were constructed with the standard Subtitle D composite liner system (i.e., two feet of clay with a permeability less than or equal to  $1 \times 10^{-7}$  cm/sec in combination with a 60-mil HDPE synthetic liner) as described in 40 CFR 258.40(b) and Section 1600 of the North Carolina Solid Waste Management Rules. In 1999, Cell 3 was constructed with an alternate composite liner system (18-inches of  $10^{-5}$  cm/sec clay, a geosynthetic clay liner [GCL], and a 60-mil HDPE synthetic liner). The State of North Carolina did not allow alternate liners until 1998. The County recently bid and expects to begin construction by August, 2000 on Cells 4 and 5 which will also be constructed with the alternate liner system. This agreement is intended to potentially cover all ten cells of the landfill, with a decision point for the parties and stakeholders contingent upon a review and evaluation of data

from cells 1-5 as well as an assessment of project success every five years which will coincide with the decisions to renew the landfill's operating permits.

As noted previously, both the Federal and State regulations allow leachate recirculation over the standard composite liner system prescribed in Subtitle D, however, neither allow it over cells constructed with alternate liners. On Cell 3, the alternate liner system saved Buncombe County nearly \$400,000 as compared with the standard composite system. It is estimated that the County will save a total of \$5 million through build-out of the facility if the alternate liner system is used. Other potential cost savings from the project include:

- \$5 - \$10 million in reduced construction costs for additional landfill capacity if an increase of 20%-30% in additional waste volume can be achieved due to rapid waste decomposition during operations; and,
- \$9 million if leachate hauling and off-site treatment can be eliminated.

Maintaining the region's pristine surface water and groundwater, and clean air, are high priorities for the County's elected officials and staff. The proposed leachate recirculation and gas recovery system will serve to support these goals.

Combining leachate recirculation with gas recovery at a Subtitle D landfill has been shown at the pilot scale to provide numerous environmental benefits. Currently however, the Subtitle D regulations restrict leachate recirculation to only those landfills that have been constructed with the standard composite liner system prescribed in the regulations (i.e., two feet of clay with a permeability of not more than  $10^{-7}$  cm/sec and a 60-mil HDPE synthetic liner). The goal of this XL Project will be to demonstrate that leachate can be safely recirculated over equivalent, alternate liner systems (which in many cases are less expensive than the conventional Subtitle D composite liner system) and thus provide the basis for future regulatory changes that will allow this superior environmental performance to be achieved at similar facilities across the country. The superior environmental benefits that Buncombe County expects to achieve with this project are:

- Rapid organic waste conversion/stabilization leading to rapid settlement, increased gas yield and capture, improved leachate quality, reduced post-closure costs, and reduction in the potential for uncontrolled releases of leachate and/or gas to contaminate the ground water or air during the post-closure phase should a containment system failure occur.
- Maximizing landfill gas capture for better and more efficient energy recovery and reduction of fugitive air emissions. Studies to determine the market and feasibility for use of the enriched gas produced during recirculation of leachate will be conducted as part of



this XL project. Reduction in air quality impacts from the facility is of primary importance since air inversions and the resulting degradation in air quality are common in the mountains.

- Increased landfill disposal capacity due to rapid settlement during the operational period that leads to more economical operations, deferred capital costs for additional landfill capacity, and delay in the siting and construction of a new facility.
- Improved leachate quality and a reduction in leachate quantity. Research has shown that leachate recirculation allows for more time for decomposition of organic contaminants; adsorption of certain inorganic contaminants into the soil/waste matrix; and, enhanced chemical reactions such as metals precipitation. All of these processes will improve the quality of the leachate that is discharged to the local publicly owned treatment works (POTW) which should reduce any strain on the facility caused by the leachate. The quantity of leachate is reduced through adsorption by the waste and soil as well as by consumption during biological activity. Because leachate from the Buncombe County facility is hauled by tanker truck to the POTW, a reduction in the amount of leachate requiring treatment will result in fewer tanker trucks on the roads creating a safer situation for nearby residents.
- Reduction in post-closure care, maintenance, and risk through rapid waste stabilization.

Therefore, to realize these superior environmental benefits as well as the cost savings discussed previously, Buncombe County is requesting that U.S. EPA and the State of North Carolina, Department of Environment and Natural Resources (NCDENR) grant site-specific regulatory flexibility from the prohibition in 40 CFR 258.28, Liquid Restrictions, which prohibits the recirculation of leachate over cells constructed with an alternative liner.

Some studies indicate that the amount of leachate generated at most landfills, even those in wet climates, will not be enough to totally saturate the waste mass thereby not achieving maximum waste decomposition. Buncombe County is requesting additional flexibility in 40 CFR 258.28 to allow the addition of supplemental liquid to the waste mass should the amount of leachate available become limiting at any time during operations. Water diverted from the neighboring French Broad River will be the only source of supplemental liquids circulated. Buncombe County requests similar flexibility from NCDENR for supplemental liquid addition if needed.

It is recognized that the addition of supplemental liquids may decrease the strength of the waste mass and, if not designed properly, decrease the stability of the landfill. Prior to adding any supplemental liquids to the facility, Buncombe County will prepare a comprehensive landfill stability analysis under recirculation conditions with supplemental liquids. Buncombe County will

submit this analysis to two of the three following university professors who are recognized as experienced in the field of geotechnical engineering in general and landfill slope stability specifically: Dr. Timothy Stark, University of Illinois; Dr. Craig Benson, University of Wisconsin, and, Dr. Robert Koerner, Drexel University. The County will incorporate comments from these professors into a final stability analysis for their final review. The County will forward the analysis along with letters from the reviewing professors stating that the landfill should remain stable under the operating plan developed by the County, to the USEPA and the State of North Carolina for concurrence prior to adding any supplemental liquids. Should two of the professors mentioned above be unable to conduct the review, the County will suggest an alternate that is acceptable to USEPA and the State.

Finally, Buncombe County intends to continue to recirculate leachate consistent with this agreement and in compliance with all applicable regulations throughout the landfill as long as gas generation data shows that biological activity continues and leachate flow and quality data show that improvements in leachate quality and reductions in quantity are occurring. It is expected that this will occur long after each cell has reached its permitted final grade. As long as these processes are ongoing, it is expected that waste decomposition and the resulting settlement will continue to occur. As mentioned above, one of the superior environmental benefits expected from this project is the additional airspace for waste disposal made available by more rapid waste settlement.

#### **B. Description of the Facility and Facility Operations/Community/Geographic Area**

The Buncombe County Solid Waste Management Facility (BCSWMF) is an existing Subtitle D landfill permitted by NCDENR, Solid Waste Section. The 600+ acre facility is located in northern Buncombe County about two miles from the Madison County line. NC 251 borders the facility to the south and west. Access to the site is from the northwest off of Panther Branch Road (SR 1745). A prominent physical feature of the facility is the French Broad River that borders the site to the south and west. The BCSWMF accepts non-hazardous municipal solid waste generated within the County for disposal in the Subtitle D landfill portion of the site. Construction and demolition waste is accepted and disposed of in an approved construction and demolition debris landfill also located on the site. Tires and white goods are accepted as well and they are processed prior to being shipped off-site for recycling and/or disposal. Wood and yard wastes are processed into mulch and sold to the public. Common household recyclables are also collected at the facility.

Since opening in September 1997, the Buncombe County Solid Waste Management Facility has received several prestigious awards including:

- 1998 Honors Award for Engineering Excellence from the North Carolina Consulting Engineers Council.

- 1999 Gold Award for Outstanding Integrated Solid Waste Management Program from the North Carolina Chapter of the Solid Waste Association of North America (NC SWANA)
- 1999 Bronze Award for Excellence in Solid Waste Management in North America, Landfill Category, from the Solid Waste Association of North America (SWANA).
- 2000 Award for Outstanding County Program from the North Carolina Association of County Commissioners for its Hazardous Waste Handling, Reduction, and Education Program.

The Subtitle D landfill portion of the BCSWMF comprises 100 acres. The site has been segregated into 10 distinct cells of varying size depending on topography. Cells 1 and 2, which combined are approximately 14 acres in size, were constructed as part of the initial facility construction. Both of these cells were constructed with the standard Subtitle D composite liner system. Two feet of crushed stone was used to construct the protective cover/leachate collection and drainage system. The synthetic liner is protected against abrasion and puncture from the stone and waste by a 28-oz. fabric cushion. Leachate is drained to a sump area located in each of the ten cells and then pumped to an on-site lined, leachate storage lagoon with 1.5 million gallons of capacity. Leachate is currently hauled approximately seven miles by tanker truck to a wastewater treatment plant owned and operated by the Metropolitan Sewerage District of Buncombe County (MSD).

The majority of ground water underlying the BCSWMF lies within a fractured bedrock aquifer system. Depth to ground water varies considerably across the site ranging from about five feet in the low lying areas to as much as 200 feet along the ridge lines. Because of the complexity of the ground water flow regime, it was decided during permitting that a standard perimeter network of ground water monitoring wells would need to be supplemented by an additional monitoring system. The alternative monitoring system agreed upon consists of a synthetically lined collection area located three feet below the bottom of the composite liner system. The lined area mirrors the bottom grades of each cell. The extent of the liner was determined by the wetted perimeter in the cell under precipitation from the 100-year storm. Any water collected in the alternative monitoring system drains to a sump and then out of the landfill through a sealed pipe. Samples are taken from the pipe during each semi-annual ground water monitoring event. There are currently nine ground water monitoring wells located around the perimeter of the site. Additional wells will be added as the Subtitle D portion of the site is expanded.

The BCSWMF is located in a rural part of Buncombe County. Surrounding land uses within one mile of the site are predominantly rural residential with some small agricultural activities. In 1992,

during initial permitting of the site, there were 34 residences located within one-quarter mile of the site. There has not been any widespread development in this area in the intervening years, thus the number of residences is relatively the same. The majority of homes are located to the east and northeast of the site. There are neither water nor sewer utilities near the site nor any industrial buildings. There are four primary roads within one-quarter mile of the site. Each road is a state-designated, two-lane road.

### **C. Purpose of the Agreement**

This Final Project Agreement ("the Agreement") is a joint statement of the plans, intentions, and commitments of the U.S. Environmental Protection Agency ("EPA"), the State of North Carolina, and Buncombe County, North Carolina to carry out this project approved for implementation at the county's solid waste management facility site near Alexander, North Carolina. This Project will be part of EPA's Project XL program to develop innovative approaches to environmental protection.

The Agreement does not create legal rights or obligations and is not an enforceable contract or a regulatory action such as a permit or a rule. This applies to both the substantive and the procedural provisions of this Agreement. While the parties to the Agreement fully intend to follow these procedures, they are not legally obligated to do so. For more detail, please refer to Section VI (Legal Basis for the Agreement).

Federal and State flexibility and enforceable commitments described in this Agreement will be implemented and become effective through a legal implementing mechanism such as a rule or permit modification.

All parties to this Agreement will strive for a high level of cooperation, communication, and coordination to assure successful, effective, and efficient implementation of the Agreement and the Project.

### **D. List of the Parties that Will Sign the Agreement**

The Parties to this Final Project XL Agreement are the United States Environmental Protection Agency (EPA), County of Buncombe General Services Department, and the State of North Carolina.

## **E. List of the Project Contacts**

County of Buncombe  
General Services Department  
30 Valley Street  
Asheville, North Carolina 28801  
Contact: Bob Hunter, Director

State of North Carolina  
Department of Environment and Natural Resources  
Division of Waste Management  
Solid Waste Section  
401 Oberlin Road, Suite 150  
Raleigh, North Carolina 27605  
Contact: Dexter Matthews, Section Chief

U. S. Environmental Protection Agency, Region 4  
Atlanta Federal Center  
61 Forsyth Street, SW  
Atlanta, GA 30303-3104  
Contact: Michelle Cook, Region 4 Project XL Coordinator

## **II. Detailed Description of the Project**

### **A. Summary of the Project**

Sanitary landfilling is the dominant method of solid waste disposal in the United States, accounting for about 217 million tons of waste annually (U.S. EPA, 1997). The annual production of municipal solid waste in the United States has more than doubled since 1960. In spite of increasing rates of reuse and recycling, population and economic growth will continue to render landfilling as an important and necessary component of solid waste management.

In a landfill which incorporates combined leachate recirculation and gas recovery, controlled quantities of liquid are added, and circulated through waste as appropriate, to accelerate the natural biodegradation and composting of solid and liquid waste components. This process significantly increases the biodegradation rate of waste and thus decreases the waste stabilization and composting time (5 to 10 years) relative to what would occur within a conventional landfill (30 years, to 50 years or more). If the waste decomposes (i. e., is composted) in the absence of oxygen (anaerobically), it produces landfill gas. Landfill gas is primarily a mixture of methane, a potent greenhouse gas, carbon dioxide, and VOC's, that are local air pollutants. Methane is also a

fuel. This by-product of landfill waste decomposition (composting) can be a substantial renewable energy resource that can be recovered for electricity or other uses. Other benefits of this type of landfill operation include: increased landfill waste settlement (and therefore an increase in landfill capacity and life); improved leachate quality, possible reduction of landfill post-closure efforts required; landfill mining; and, abatement of greenhouse gases through highly efficient methane capture over a much shorter period of time than is typical of waste management through conventional landfilling.

## **B. Specific project elements**

Buncombe County intends to construct and operate a combined leachate recirculation and gas recovery system throughout its 100-acre Subtitle D landfill area. Currently, Cells 1-3 of the 10-cell design are in operation. These cells cover approximately 23 acres. Cells 4 and 5, which will cover approximately 20 acres, are expected to be under construction by mid-summer 2000 and in operation one year later. Cells 1 and 2 were constructed with the standard Subtitle D composite liner while Cells 3-5 were/will be constructed with an alternative liner approved by the NCDENR. Because of the presence of the separate alternative ground water monitoring system beneath each cell, the performance of the two types of liner systems can be evaluated as increased amounts of liquid are introduced to the cells.

### **DESIGN AND OPERATIONS OF PROPOSED LEACHATE RECIRCULATION/GAS RECOVERY PROJECT**

As mentioned previously, two types of liner systems have been installed at the BCSWMF. Cells 1 and 2 (approximately 14 acres in size) were constructed with the standard Subtitle D composite liner system (i.e., two feet of  $1 \times 10^{-7}$  cm/sec clay overlain with a 60-mil HDPE synthetic liner). Cell 3 (approximately 8 acres in size and currently in operation) and the remaining cells yet to be constructed will have an alternate liner designed and constructed in accordance with North Carolina regulations. The alternate liner used in Cell 3 and proposed for all future cells, consists of 18 inches of  $1 \times 10^{-5}$  cm/sec clay overlain by both a geosynthetic clay liner (GCL) and a 60-mil HDPE synthetic liner. The GCL, consisting of a bentonite core and encapsulating polypropylene geotextile, will have a maximum permeability of  $5 \times 10^{-9}$  cm/sec. The HDPE synthetic liner shall conform to all applicable ASTM standards for textured and smooth HDPE liner. Based on groundwater modeling required by the State of North Carolina to demonstrate equivalency it appears that the alternative liner is actually more protective than the standard composite system (reference supporting documentation).

The leachate collection systems in all ten cells are distinct (i.e., not interconnected) and each drain to a separate sump. The internal slopes of Cells 1-5 are significant and range from 8.5% to 21%. Considering the internal slopes along with the highly permeable crushed stone drainage layer,

almost no head is built up on the liner system except in the sump area. A submersible pump installed in each cell pumps/will pump leachate through a common force main located around the perimeter of the landfill to the lined storage lagoon. The submersible pumps are set to switch on when the head builds up to 12 inches. Given the slopes, the area that actually experiences 12 inches of head before pumping is initiated is quite small. A new pump system will be constructed at the leachate storage lagoon to pump leachate back through a new, dedicated force main to the cells for recirculation.

### **Liner and Leachate Collection and Removal System (LCRS) Components**

As mentioned, Cells 1 and 2 at the Buncombe County SWMF were constructed with the standard Subtitle D composite liner system. Cell 3 was constructed with a GCL/synthetic alternative liner system. Buncombe County, through this XL Project, intends to construct the remaining cells at the landfill with the alternative liner. The leachate collection system in each cell consists of two feet of locally generated crushed stone. In Cells 1 and 2, the internal cell slopes and permeability of the stone were sufficient to convey leachate to the sump areas without the use of collection pipes. The slopes in Cell 3 were somewhat less and thus one central collection line was installed. Collection pipes will be used in Cells 4 and 5. The synthetic liner is protected from the crushed stone drainage layer by a 28-oz. cushion fabric. The literature tends to recommend a 12-oz. fabric in this application, however, Buncombe County has decided to be conservative since the amount of data backing the available research is not significant.

### **Liner and LCRS Performance**

40 CFR Part 258.28 already allows for leachate to be re-circulated in cells constructed with the standard Subtitle D composite liner. Performance of this alternate liner system will be monitored by the leak detection system underlying each cell. The alternative liner system constructed in Cell 3 and proposed for Cells 4-10 was thoroughly researched by the State of North Carolina before being proposed as a prescriptive alternative in the rules. The State's alternate liner design document calculated that the leakage rate through the standard Subtitle D liner system under a set of standard conditions was 1.12 gal/acre/day while through the alternative used in Cell 3 was only 0.53 gal/acre/day. Thus, the alternative liner being used at the Buncombe County MSWLF appears to perform in a manner at least as protective as the standard composite and, most likely, significantly more protective (modeling of both liners indicated the alternative liner would afford almost 50 percent more protection to the underlying aquifer than the composite liner).

Camp, Dresser, and McKee (CDM), under contract to Buncombe County, performed preliminary calculations on the performance of the crushed stone leachate drainage layer under anticipated leachate re-circulation conditions. Due to the high permeability of the crushed stone layer, the expected maximum depth of leachate under non-recirculation conditions is 0.03 feet. Therefore,



there is a significant design cushion to handle additional leachate flows expected under recirculation conditions. The crushed stone drainage layer has tremendous liquid carrying capacity which is why the expected maximum leachate depth is so small, and the slopes on the mountainous site allow rapid conveyance of the leachate to the sump area.

Buncombe County will demonstrate adequate performance of both the liner and leachate collection systems to the State of North Carolina during the permitting of the leachate recirculation/gas recovery system.

### **Specialized Design Considerations During Operation**

Leachate will be applied during operations to provide enhanced conditions for rapid waste decomposition. It is possible that additional water will be needed to achieve and/or maintain optimal moisture levels in the landfill and thus, if needed, Buncombe County intends to supplement leachate recirculation with water withdrawn from the adjacent French Broad River. Cells 1 and 2 are near final grade and thus it is anticipated that leachate recirculation will be accomplished with both horizontal injection trenches and vertical injection wells. Most likely, both types of injection systems will be used to collect landfill gas as well. All leachate will be injected below the landfill surface to prevent contact with employees or users of the landfill. If supplemental river water is used it will either be discharged into the leachate pond and then pumped into the landfill, or applied to the working face of the landfill by a tanker truck. Moisture levels will be monitored and the recirculation system will be designed so that leachate can be applied or discontinued in small, distinct areas as needed. Table 1 identifies the Instrumentation Type and Location for the Bioreactor Project.

Moisture content will be monitored throughout the life of the Project through the use of a network of moisture sensors to be installed during waste placement. Buncombe County officials traveled to Yolo County, CA (the location of a similar, proposed XL Project) on June 29, 2000, to evaluate the moisture detection system that was used successfully on their pilot projects. The County will review what has worked and what has not, and then incorporate the final design of the moisture detection system during the preparation of permitting documents.

The quantity of leachate and supplemental water added back to the landfill will be measured throughout the life of the project. Buncombe County expects to quantify recirculation quantities using flow sensors installed on the leachate discharge line at the leachate storage pond, as well as the individual lines that feed each cell in the landfill. The goal of the system design will be to quantify the amount of leachate recirculated to each cell individually.

**Table 1- Instrumentation Type and Location for the Bioreactor Project**

<b>Type of Instrumentation</b>	<b>Location</b>	<b>Description</b>
<b>Pressure transducers</b>	Above primary liner and leachate collection system in the landfill cells	A series of pressure transducers will be installed on top of the primary liner in the LCRS trench in the anaerobic landfill cells to measure the head or depth of leachate above the liner. Total of eight pressure transducers will be installed, four in each cell at 200 feet spacing. A gas pressure transducer in each cell will be used to correct the liquid head for gas pressure.
<b>Moisture and Temperature Sensors</b>	Sensors will be placed on top of the primary liner and within the waste mass at three different depths at 20 feet intervals.	A series of moisture and temperature sensors will be installed within the waste mass to monitor the biological activity of each cell. Instrumentation will be installed directly on top of the bottom primary liner and at three different depths within the waste mass at an interval of 20 feet.
<b>Gas Composition, Gas Pressure, and Gas Flowmeter</b>	Gas extraction and collection pipelines using NSPS approved methods.	Chipped tire as part of the gas collection system will be installed at every lift to either collect landfill gas or inject air in the landfill. Pipes will be installed in each lift after placement of waste and chipped tires. Gas will be sampled from either the main collection pipe or each individual lift of waste to determine gas composition or

		measure gas pressure. The gas pressure and composition will be measured manually. Gas flow measurement will be continuous and automated.
<b>Leachate Flow Measurement</b>	Outflow and inflow from each cell is measured at each sump and at the injection manifold.	The quality of leachate added or collected from the LCRS is measured by flowmeters from each cell. The volumes of liquids are monitored from each cell continuously through a data collection system.

As discussed previously, the leachate collection/drainage layer constructed in each cell has been and will continue to be two feet of crushed stone. HELP model analyses show that, due to the internal cell slopes and high permeability of the crushed stone layer, there will be very little head buildup on the liner even when simulating high recirculation levels. The performance of the alternative liner system, especially under recirculation conditions that could produce higher head conditions, is of concern to U.S. EPA. While it can be shown with the HELP model that head buildup within the crushed stone leachate drainage layer will not be a problem, Buncombe County will install devices that can monitor head levels. This will be considered during the preparation of permitting documents. Leachate recirculation will be suspended in any cells where there appears to be head build up.

Improvement in leachate quality during recirculation operations is a claim made by proponents in the literature. This is an important environmental benefit of the project since improving leachate quality should be indicative of a stabilizing waste mass. Since leachate is pumped from each cell individually, Buncombe County intends to sample the leachate from each cell semi-annually for parameters that will be able to establish whether or not leachate quality is indeed improving.

The degradation and gas production of the waste mass is also related to the temperature within the decomposing waste. The effectiveness of the system is dependent on keeping the system within optimum temperature ranges, therefore, Buncombe County will install temperature gauges to aid in operation of the system. As with the moisture sensors, temperature gauges will also be installed as waste operations progress.

The Buncombe County MSWLF lies within a seismic impact zone as defined in 40 CFR Part 258. Adding liquids back into the landfill will increase the moisture content of the waste mass and raises the issue of whether or not this will make the waste mass less stable. Camp Dresser & McKee has re-run stability calculations that were completed during initial permitting of the facility

to assess the stability of the landfill and waste mass under these higher moisture conditions as well as during seismic events. The calculations show that significant increases in moisture content (i.e., within the range expected in a recirculation project) will have essentially no impact on waste mass or landfill stability, even during design seismic events. These calculations will be finalized and submitted as part of the County's permit amendment package that will be necessary to construct the proposed system.

As areas of the landfill reach design grade, Buncombe County will install monuments to monitor settlement caused by the degradation of the waste. These monuments will be checked semi-annually to track settlement. Annual aerial topographic surveys will also be performed to aid in the evaluation of settlement and the effectiveness of the leachate recirculation/gas recovery system.

Landfill gas will be collected from the landfill utilizing the horizontal and vertical trenches to be used for leachate recirculation. The total number of trenches to be installed for the initial phase of construction is 31. The trenches range in length from 150 to 500 feet. Separate header piping will be installed parallel to the leachate recirculation piping and interface at the head of each trench. The components of the system include:

- \* Gas Main - the HDPE pipe that conveys the gas from the landfill to the flare station.
- \* Header Piping - the HDPE piping that conveys gas from the horizontal collection trenches to the gas main. Plastic valves will be installed at various locations to control the collection process.
- \* Horizontal Injection/Collection Trench (HICT) - a perforated HDPE pipe placed in a 2-ft by 3-ft stone trench which is located within the waste; the HICT provide the conduit by which leachate is recirculated and landfill gas is collected.
- \* Wellhead Connection - this assembly will connect the header piping to the HICT; the connection includes valving, a flexible connection to accommodate settlement, a sampling port to monitor gas composition and pressure, a temperature gauge, and an orifice plate for measuring flow rate.

Gas will also be collected from the leachate collection system by connecting the gas main to the leachate sump. The components of this system that will be utilized for gas collection include the following:

- \* **Gas Main** - the same as described above, the main will be connected to the leachate riser pipe.
- \* **Leachate Riser Pipe** - the HDPE pipe that provides access to the leachate sump for the pumping system.
- \* **Leachate Sump** - a 24-inch diameter, perforated, HDPE pipe that is installed in the low point of each cell.
- \* **Wellhead Connection** - this assembly will connect the gas main to the leachate sump; the wellhead includes valving, a flexible connection to accommodate settlement, a sampling port to monitor gas composition and pressure, a temperature gauge, and an orifice plate for measuring flow rate.

It is anticipated that gas collection will begin sometime during the active filling stage of the landfill as a result of the accelerated generation of landfill gas. Once the gas system begins operation it will run continuously. The HICT will be installed at various elevations in the landfill as filling progresses to provide adequate coverage of the waste mound. It is anticipated that the uppermost tier of HICT, at any given time, will be used only for gas collection to control odors and gas emissions.

The lower tiers of HICT will be used for both leachate recirculation and gas collection. Gas collection from the leachate collection system and uppermost tier of HICT will envelop the gas being generated within the landfill and control release to the atmosphere.

Pressure, temperature, methane and oxygen concentrations at the active extraction points will be monitored at each wellhead on a monthly basis. The gas collection system will require periodic adjustments to maintain optimum performance during operation. During routine inspections, the operator will monitor and adjust the vacuum at the active gas collection trenches as needed to maximize system performance. The vacuum applied at individual extraction points can be adjusted using the valve provided at the wellhead connection. The vacuum can also be adjusted at the blower. However, if the vacuum is adjusted at the blower, the collection points throughout the system must be evaluated for performance. The following steps provide an outline of the system operation:

1. Each trench is equipped to recirculate leachate and collect gas. Since leachate recirculation will cause accelerated quantities of gas to be generated it is important that the gas collection system be ready to operate during the active filling stage. However, these processes should never be operated simultaneously in a HICT. Concurrent operation of leachate recirculation and gas collection at an HICT will result in flooding of the gas collection system.

2. Monitoring of the wellheads at the HICT will be necessary to provide indication of when gas generation begins.

3. In addition to confirming the generation of gas, the following criteria must be met before activating an HICT for gas collection:

- \* A minimum of 20-feet of waste must be present over an HICT. This is required to prevent excessive air intrusion into the system.
- \* A minimum of 1 week of draining time must be maintained before collecting gas from an HICT that has been used for leachate recirculation. This is to prevent the potential for flooding of the gas header.

4. If the presence of gas is confirmed and there is no sign of positive leachate pressure, then gas collection from an HICT can be operated until the next scheduled recirculation event at that HICT. Important: The wellheads should be installed with clear flexible tubing to allow the operator to visibly check for leachate flow.

5. The leachate collection system will also be utilized to collect gas from the landfill. Well heads will be installed at the riser pipe of each cell. A minimum of 20-feet of waste must be present in a cell before gas collection from the respective riser pipe may begin. It is anticipated that 20-feet of compacted waste will be sufficient to prevent air intrusion. However, the system should be monitored to verify that air intrusion is not occurring during the initial use of a leachate collection system for gas collection.

6. By utilizing the leachate collection system and the uppermost tier of HICT at any given time during the operation of the landfill, the system is designed to promote gas collection at the bottom and top of the waste mass by creating negative pressure in these two zones. The injection of leachate into HICTs in the center of the waste mass will enhance collection in these two zones by filling the void spaces in the waste with leachate (i.e., the gas will be forced to migrate to less saturated zones). However, gas collection will also be performed in the middle zone. Any HICT that has not received a leachate injection for more than 1 week may also be used for gas collection. The rotation of HICT employed for gas collection will be coordinated with the recirculation schedule to be established.

Cover material selection and application requires special consideration when operating a leachate recirculation system. Daily cover material will be sandy soils or some form of permeable alternative cover since clay soils and plastic tarps will block flow paths and inhibit lateral migration of the leachate. In areas in which additional waste will be placed, intermediate cover will be removed before placing the next lift to prevent blocking vertical flow paths and forming perched leachate zones. Removal of intermediate cover will also decrease the chance of leachate

seeps through the side slopes. Intermediate cover placed at final elevations will use clayey soils to block gas migration and leachate seeps. The placement of final cover will occur when filling is complete in a substantial area. However, placing waste to the design elevations will not necessarily constitute a completed filling area. As a result of recirculation, settlement will occur over a shortened time frame causing much of the settlement to occur while the landfill is still active. A significant amount of additional capacity will be obtained by returning to previously filled areas and placing more waste in the settled areas. Final cover will be installed after additional waste is placed and the capacity of the landfill is maximized.

### **III. How the Project Will Meet the XL Criteria**

#### **A. Superior Environmental Performance**

##### **1. Tier I: Is the Project Equivalent?**

The literature on landfills conducting combined leachate recirculation and gas recovery identifies no significant adverse environmental impacts relative to those created by conventional landfill practice. Although leachate may be generated/recovered in quantities at times greater than that in conventional landfilling, the leachate collection, pumping, and storage systems are currently designed to handle the additional projected flows. The leachate storage pond is currently sized to handle leachate from the ultimate build-out of the landfill. During design of the leachate recirculation system, calculations will be made to determine if additional storage capacity will be needed when Cells 6-10 are put into operation. It is hoped that, once the system is in full operation, that the need for off-site hauling and treatment of the leachate will be eliminated. The County intends to keep its pre-treatment permit in effect and haul leachate off-site should emergency conditions dictate. It should be noted that leachate will be injected at least several feet below the active working level of the landfill thus there should be no exposure to those using or working at the landfill.

The design capacity of the Buncombe County Subtitle D landfill subjects it to regulation under 40 CFR Part 60 Subpart WWW of the Clean Air Act. Based on a recent Tier I analysis for the landfill, given its current design capacity and waste acceptance rate, it is anticipated that the landfill's emissions of nonmethane organic compounds (NMOC) will exceed 50 Mg/yr in 2001. At that point, the County could either initiate the design of a gas collection and control system, with 30 months allowed for startup of the system, or it could conduct a Tier II analysis to determine the possibility of postponing the installation of a gas collection and control system by at least five years. Because Tier II testing has not been performed, it is unknown how the landfill's NMOC concentration may differ from the default Tier I value. The proposed gas collection system will be designed to comply with Subpart WWW and will be in-place and operational when

recirculation starts and before it would be required under the rule. Therefore, overall and total lifetime fugitive emissions from the site will be reduced. The U.S. EPA is a strong proponent of landfill gas recovery and control through its Landfill Methane Outreach Program, among other initiatives.

This particular XL project will provide environmental performance at least equivalent to Tier 1 in all areas.

## **2. Tier 2: Superior Environmental Performance**

### **a. Maximizing landfill gas control and minimizing fugitive methane and VOC emissions.**

Landfill gas contains roughly 50% methane, a potent greenhouse gas. In terms of climate effects methane is second in importance only to carbon dioxide. Landfill gas also contains volatile organic compounds (VOC's) that are local hazardous air pollutants. At closure, landfill gas capture is maximized by a surface permeable gas collection layer overlain by a cover of soil with embedded membrane. Gas is withdrawn to maintain this permeable layer beneath surface containment at slight vacuum. It is anticipated that the capture of methane is further facilitated and eased by a shortened generation interval, from 30 to 50 years to between 5 to 10 years through enhanced decomposition afforded by leachate recirculation. Buncombe County is proposing to install vertical gas wells in areas that have already reached final grade and horizontal collection trenches in operational areas to collect gas throughout the active life of the site. With this gas capture approach, it is expected that fugitive landfill gas emissions will be reduced for reasons that include:

- Reduction in emissions through installation and operation of gas collection system before the final fill height is reached, and before it would be required by the current Clean Air Act NSPS regulations.
- Collection efficiency improvements with the proposed horizontal gas extraction method over vertical gas well efficiency.
- Reduction in long term emissions, from landfill gas generation occurring slowly beyond 30 years of post-closure, which are not easily controlled.

Other bioreactor demonstration projects have already shown close to a tenfold increase in methane recovery rates, which suggest a tenfold reduction in interval of methane generation. Available indications as well as basic physical principles suggest that capture effectiveness



approaches 100%, so long as vacuum is maintained under the permeable layer, cover integrity is maintained and the collection system is designed and maintained to collect the maximum amount of LFG generated at the site.

**b. Expedited methane gas generation/recovery.** Methane recovery is maximized by use of permeable gas collection layers as discussed above and also facilitated by methane generation over much shorter terms. This is expected to minimize long-term low-rate methane generation often lost to energy use in conventional landfill practice. The reliability of methane recovery of fuel for energy generation should reduce the uncertainty and improves economics of landfill gas projects. Greater use of methane to full potential can add still more greenhouse benefit by replacing fossil CO<sub>2</sub> otherwise emitted with fossil energy use elsewhere.

A recently completed study for the Federal Energy Technology Center (FETC, presently becoming the National Energy Technology Laboratory, NETL) of the U. S. Department of Energy indicates that wide application of controlled landfilling could reduce US greenhouse gas emissions by 50-100 million tons of CO<sub>2</sub> equivalent when both emission prevention and fossil CO<sub>2</sub> offsets are taken into account. This major reduction in CO<sub>2</sub> emissions is also cost-effective. In the analysis for FETC (IEM, 1999), over a range of representative landfill conditions, greenhouse gas abatement was estimated as attainable at a cost of \$1-5/ton CO<sub>2</sub> equivalent which represents extremely low (by more than tenfold) cost compared to most other options presented in the recent EIA Report (USDOE Energy Information Agency, 1998).

Buncombe County currently intends to flare the recovered gas in an approved control device while it seeks feasible reuse opportunities. It should be noted that the County currently extracts and sells landfill gas from its closed landfill to an adjacent wastewater treatment plant. The County is committed to trying to find a feasible re-use project for the landfill gas generated at its current facility.

**c. Landfill life extension and/or reduced landfill use.** The more rapid conversion of greater quantities of solid waste to gas reduces the volume of the waste. Settlement in a test cell in Yolo County, California is already over 18% in three years. Volume reduction translates into either landfill life extension and/or less landfill use. Thus, landfills that recirculate leachate and recover gas are able to accept more waste over their working lifetime. Alternatively, fewer landfills are needed to accommodate the same inflows of waste from a given population.

**d. Leachate-associated benefits:** Leachate recirculation promises more rapid leachate stabilization in terms of pollutant load, reduced leachate environmental impact, and elimination of

need for most discharges to treatment facilities. The biological processes, both anaerobic and aerobic, which are enhanced by the recirculation of leachate, have been shown in studies at many scales to reduce the content of many leachate pollutants. These include organic acids and other soluble organic pollutants. Since a biologically active landfill operation brings pH to near-neutral conditions, metals of concern are largely precipitated and sequestered/ immobilized in waste. Thus free liquid concentrations and mobility of metals are reduced compared to "conventional" landfill practices, where more contaminated lower-pH leachate is often observed to be generated slowly for years. For example, in the aforementioned Yolo County test cell demonstration, leachate reached near-neutral (pH 7) conditions within four months after liquid additions and recirculation commenced.

The need for off-site leachate treatment should be reduced as long as waste landfilling continues concurrently with leachate recirculation/gas recovery operations. Additional leachate that would have to be treated at a wastewater treatment facility could be avoided. Because this type of operation sometimes requires extra liquid for optimum performance, and leachate and condensate re-introduction are permissible under specified circumstances (40 CFR 258.28), continuing liquids recirculation allows generated leachate and condensate to be reintroduced so long as new dry waste continues to flow into the landfill.

Improvements in leachate quality are expected to consist of organic compound reduction through increased biological activity and inorganic reductions by adsorption to the waste mass and soil, and by chemical reactions, such as metals precipitation.

**e. Lessened long-term risk and need for monitoring.** The leachate recirculation/gas recovery mode of landfill operation offers potential for substantial reductions in post-closure care needs and costs. With present conventional practice, it is highly likely that gas management will be required for at least a mandated 30-year post-closure period. This entails all of the associated expense of continuing monitoring and gas well adjustment. A number of other management needs occur as waste continues to decompose, including dealing with subsidence, gas collection line breakage caused by subsidence, and the like. Rapid decomposition of the waste during and shortly after disposal operations cease will likely reduce the potential for the facility to generate significant quantities of high strength leachate or landfill gas. This will reduce the long-term risk of ground water contamination and gas migration should there be a breach in either the top or bottom containment systems.

**f. Landfill gas energy project potential.** The recirculation of leachate and other liquids has been demonstrated to increase the rate and quantity of gas generation. Increased quantities of gas can make a gas-to-energy project more feasible. Since the current plan is to flare the gas at the

Buncombe County SWMF, identifying and constructing a beneficial reuse project could eliminate the use of another fuel on another project and its emissions. Buncombe County is currently in the initial stages of evaluating possible greenhouse projects as well as converting the gas to a fuel usable by county vehicles.

**g. Landfill Mining Potential.** The removal and re-use of waste for beneficial purposes, such as compost or landfill daily cover is a distinct possibility in the future. If landfill mining is carried out, it would occur when stabilization has sufficiently been achieved. Because the cells will be operated anaerobically, this could be beyond the expected term of the XL agreement.

### **3. How We Will Measure Superior Environmental Performance**

Superior Environmental Performance will be measured using the baseline (Tier 1, without Project XL) against the actual results of the project (Tier 2, proposed Project XL). To determine specific project performance, the County plans to conduct monitoring as outlined in Table 2. Performance measurement against project goals is discussed further below:

**a. Maximizing landfill gas control and minimizing fugitive methane /VOC emissions.** The design capacity of the Buncombe County Subtitle D landfill exceeds the NSPS thresholds and thus the facility will have to comply with 40 CFR Subpart WWW. However, based on a recent Tier I analysis, installation and startup of a gas collection and control system might not be required until the year 2004. Although a Tier II test has not been performed to determine a specific NMOC concentration for this landfill, it is conceivable that a NMOC concentration significantly lower than the Tier I default value could allow the County to postpone the installation and operation of a gas collection and control system for at least five years and possibly indefinitely (see Section III. A. 1. above). Therefore, any gas collection before that time will be a significant environmental benefit. The gas collection and control system will be designed and operated to meet all Subpart WWW criteria. Monitoring of system performance will include surface methane emissions testing to track and confirm the collection effectiveness of the system. Because bioreactors generate more landfill gas earlier in the lifespan of the facility compared to standard MSW landfills, it will be necessary for gas collection and monitoring to be required prior to the time frame set out in subpart WWW, which does not contemplate bioreactor scenarios. Monitoring will continue for the duration of the project.

**b. Expedited methane generation/recovery.** It is well documented in the literature and from operating leachate recirculation/gas recovery landfills that expedited gas generation will occur in these types of landfills. The gas recovery system for the Buncombe County SWMF will be

designed to account for this enhanced generation. Gas flow rates will be monitored at the control device and will be compared with gas generation rates from non-recirculating landfills.

**c. Additional waste disposal airspace through settlement.** This will be based on annual topographical surveys. Total volume loss occurring within this time interval will be calculated as well as in-place waste density to see if actual densities can exceed those calculated at non-recirculating landfills.

**d. Leachate contamination risk.** Buncombe County will measure leachate quality over time to examine trends in leachate quality and whether or not quality is improving. The County will compare its results with similar, non-recirculating landfills.

**e. Landfill gas energy project potential.** Buncombe County is a strong proponent of beneficial reuse of landfill gas. The County currently recovers landfill gas from its old, closed landfill and sells it to the MSD wastewater treatment plant which is located immediately adjacent to the site. The County is a partner and active participant in U.S. EPA's Landfill Methane Outreach Program.

## **B. Other Benefits**

As noted, results from other projects and the literature show that leachate recirculation combined with gas recovery have demonstrated a significant increase in landfill gas generation, increased landfill settlement, improved leachate quality, and highly cost-effective abatement of greenhouse gases. Preliminary economic analyses of the project show that implementing leachate recirculation/gas recovery operations can have significant cost savings and environmental benefits for the Buncombe County Solid Waste Management Facility.

## **C. Stakeholder Involvement and Support**

Stakeholder involvement is considered essential by Buncombe County and has been an important part of the County's solid waste program since the initial siting of the Buncombe County Solid Waste Management Facility in the early 1990's. Stakeholder involvement and support are critical for the success of this project. Buncombe County has already begun providing the public with information about the project via a televised (and re-aired) presentation at the Buncombe County Commissioners' Annual Planning Retreat. The State of North Carolina has been included and consulted on the project to date, and was a participant via phone during the County's proposal presentation to EPA Region 4 in February, 2000, and subsequent open meetings (May 2, June 12). The County has identified the following list of stakeholders.

Buncombe County General Services Department  
Buncombe County Board of Commissioners  
U.S. Environmental Protection Agency  
Buncombe County Environmental Affairs Board  
The North Carolina Chapter of the Solid Waste Association of North America (NC SWANA)  
The Western North Carolina Regional Air Pollution Control Agency (Title V Permit Issuer)  
The State of North Carolina, Department of Environment and Natural Resources, Waste Management Division  
Blue Ridge Environmental Defense League  
local residents

The County conducted a 30-minute briefing at the County Commissioners 2000 annual retreat which was televised and re-broadcast on numerous occasions on the County's local access government cable channel. In addition, on June 12, 2000, the County held a three-hour educational workshop on the bioreactor technology that was highlighted by a presentation by one of the foremost experts in the field, Dr. Debra Reinhart of the University of Central Florida.

Stakeholders include any individuals, government organizations, neighborhood organizations, academic centers, and companies with an interest in the progress of the Buncombe County Solid Waste Management Facility Bioreactor Project. The identification of Stakeholders was based on inviting those who are already involved in other environmental issues in the Asheville/Buncombe County area, contacting others with related interests, and by general invitation to the local population. Stakeholders provide information on the preferences of the community and may also identify un-addressed issues.

Stakeholders in the XL program typically fall into three categories; direct participants (EPA, Buncombe County, and North Carolina DENR), Commentors (citizens living adjacent to the facility, Western North Carolina Air Pollution Control Agency, the Buncombe County Environmental Affairs Board, the Blue Ridge Environmental Defense League, Sierra Club, SWANA, Quality Forward, etc.), and the general public. Additional information on proposed stakeholder involvement is available in the draft stakeholder involvement plan, dated June 2000. This document is available from any of the contacts listed in this FPA or from the EPA Project XL website at "[www.epa.gov/projectxl](http://www.epa.gov/projectxl)".

Buncombe County will convene periodic meetings of stakeholders to obtain comments on the Project as well as to report on the progress during the duration of the XL Agreement. These periodic meetings will be open to the public.

#### **D. Innovative Approaches and Multi-media Pollution Prevention**

Buncombe County intends to invest a portion of the projected savings from this project into its successful solid and hazardous waste education efforts. Buncombe County's solid waste program is the only one in the state of North Carolina that has a full-time hazardous waste officer. This person is responsible for educating local businesses and citizens about the proper handling and disposal of hazardous wastes. The hazardous waste officer conducts business inspections and in-plant consulting, as well as in home visits to residents. The hazardous waste officer also conducts an annual household hazardous waste collection day and is responsible for conducting educational programs in the schools. The goal of the hazardous waste program is to keep as much hazardous waste out of the Subtitle D and construction/demolition landfills at the new BCSWMF. The North Carolina Association of County Commissioners recently recognized the County's hazardous waste program as one of three outstanding county programs for the year 2000.

#### **E. Transferability of the Approach to Other Entities or Sectors**

Buncombe County believes that following the evaluation and approval of this proposed leachate recirculation/gas recovery landfilling concept by U.S. EPA and the State of North Carolina, many other public and private landfill owners and operators should be able to implement this type of technology. The technology is expected to yield substantial economic and environmental benefits for nearly all regions of the U. S., and, as noted, worldwide.

Following an evaluation of this XL Project by EPA, and assuming the overall success of the Project, the leachate recirculation/gas recovery landfill technology used in this project could be transferable to a subset of landfills where conditions are favorable for actively managing the decomposition process and where groundwater protection and gas control are ensured.

#### **F. Feasibility of the Project**

The project sponsor and regulatory agencies as designated in the Final Project Agreement, agree to support the project, subject to any review procedures necessary to implement the legal mechanism for this project. Further, the XL sponsor, Buncombe County, has the financial

capability, personnel and senior management commitment necessary to implement the elements of this XL Project.

### **G. Monitoring, Reporting, Accountability, and Evaluation of Methods to be Used**

The parties intend to implement as enforceable commitments, federal and state regulatory flexibility, monitoring, record-keeping, and reporting provisions of this FPA through site-specific rulemaking to implement this project. Table 2 identifies the Monitoring Parameters and Frequency for Monitoring for this project.

The enforceable requirement to initiate NSPS compliant gas collection and monitoring concurrently with recirculation activities will be implemented via a Federally Enforceable State Operating Permit (FESOP) provision. This FPA describes both enforceable and aspirational requirements, and it establishes certain limits and goals for Buncombe County's performance. The County will ensure compliance with legal requirements and ensure implementation of processes seeking to meet aspirational goals. The project sponsor will establish a record-keeping system to ensure compliance, as well as accurate reporting of environmental performance. Buncombe County will make any such reports available publicly and will specifically discuss project performance with interested stakeholder groups.

The legal mechanisms that would apply to this project include a Federally Enforceable State Operating Permit for gas collection, and site-specific rule for liquid additions. The Western North Carolina Regional Air Pollution Control Agency is the regulatory agency that has permitting authority for the Buncombe County landfill. The FESOP would contain enforceable parameters and requirements with respect to gas collection and monitoring. It would require a public notice and comment period. In addition, EPA will be issuing a proposed rule for liquid additions at Buncombe County landfill. It would also require a public comment period. Either the FESOP or the site-specific rule (as appropriate) would contain the following enforceable project monitoring requirements listed in Table 2.

**Table 2- Monitoring Parameters and Frequency for the Bioreactor Project**

<b>Monitoring Parameter</b>	<b>Frequency</b>	<b>Description</b>
<b>Leachate:</b>		
pH	Weekly	Leachate samples will be collected from each cell sump and tested. For the first six
Conductivity	Weekly	

<ul style="list-style-type: none"> <li>- Dissolved Oxygen</li> <li>- Dissolved Solids</li> <li>- Biochemical Oxygen Demand</li> <li>- Chemical Oxygen Demand</li> <li>- Organic Carbon</li> <li>- Nutrients(Ammonia Nitrogen, Total Nitrogen, and Total Phosphorus)</li> <li>- Common Ions</li> <li>- Heavy Metals</li> <li>- Organic Priority Pollutants</li> </ul>	<ul style="list-style-type: none"> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> <li>- Monthly, Quarterly</li> </ul>	<p>months starting from the initiation of recirculation. Tests will be done monthly and the next six months will be done quarterly. After the first year test will be done on semi-annually.</p>
<p><b>Landfill Gas:</b></p> <ul style="list-style-type: none"> <li>- CH<sub>4</sub>, CO<sub>2</sub>, O<sub>2</sub>, and N<sub>2</sub></li> <li>- NMOCs</li> <li>- N<sub>2</sub>O</li> <li>- Surface Emissions</li> <li>- Well Head Gas Temperatures</li> </ul>	<ul style="list-style-type: none"> <li>- Weekly</li> <li>- Semi-annually</li> <li>- Semi-annually</li> <li>- Semi-annually</li> <li>- Monthly</li> </ul>	<p>Landfill gas will be tested routinely from the anaerobic cell. Semi-annually other gas emissions will be measured by using NSPS approved methods. Surface emissions will be monitored for compliance with the 500 ppm CH<sub>4</sub> limit in Subpart WWW.</p>
<p><b>Solid Waste Stabilization and decomposition:</b></p> <ul style="list-style-type: none"> <li>- Volume of Gas Generation</li> <li>- Landfill surface topographic survey</li> <li>- Moisture Content</li> <li>- Biochemical Methane Potential</li> <li>- Cellulose</li> <li>- Lignin</li> <li>- Hemi-cellulose</li> <li>- Volume of gas</li> </ul>	<ul style="list-style-type: none"> <li>- Hourly</li> <li>- Annually</li> <li>- Annually</li> <li>- Annually</li> <li>- Annually</li> <li>- Annually</li> <li>- Annually</li> <li>- Annually</li> </ul>	<p>In the anaerobic cell the total volume of CH<sub>4</sub> and CO<sub>2</sub> will be measured continuously to determine the degree of solid waste stabilization. Another means to measure the degree of decomposition will be to conduct a topographic survey of the two cells to determine the total percent change in volume over time. Annual topographic survey will be done on the top surface of each cell.</p> <p>If funding is available solid waste samples may be</p>



		collected to determine the degree of stabilization. Samples of waste may also be tested for heavy metals and organic pollutants.
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Additionally, Buncombe County voluntarily commits to providing the following information to project stakeholders and regulators in order to facilitate the project's evaluation:

- Quantities of leachate recirculated in each cell, and the amount of supplementary liquids added to each cell.
- Quarterly reporting on the data collected by the moisture sensors located within each cell.
- Semi-annual reports on changes in the quality of the leachate subsequent to recirculation in each cell.
- Quarterly reporting on the data collected by temperature gauges installed in each cell.
- Semi-annual reporting on settlement in each cell as measured against monuments installed for this purpose.
- Annual reporting and assessment of the settlement in the cells based upon topographic surveys.
- Annual reporting on studies and efforts made by Buncombe County to identify a means of utilizing, or the feasibility of selling, landfill gas as an energy source.
- Annual comparisons of gas flow rates from the bioreactor cells which have the standard double liners and the alternative liners.

Information submitted for both the mandatory and voluntary reporting elements for this project will be considered and assessed annually by EPA and the State .

#### **H. Avoidance of Shifting of Risk Burden to Other Areas or Media**

It is expected that there will be enforceable monitoring requirements in place which will ensure that no shifting of risk burden to other environmental media associated with this project. Should the alternate liner system not perform sufficiently under recirculation conditions, the underlying groundwater monitoring zone (i.e., the lined area beneath the sump areas and liner systems in each cell) will be able to detect a release early, collect the release, and form the basis for halting the project. The monitoring zone will serve to collect any release of contaminants before they reach the

underlying groundwater regime. The County agrees to conduct periodic surface emissions monitoring conducted analytically in compliance with Subpart WWW to demonstrate compliance with NSPS as well as that no additional burden of air emissions has occurred.

#### **IV. Description of the Requested Flexibility and Implementing Mechanisms**

##### **A. Requested Flexibility**

In general, Buncombe County proposes to be able to undertake a leachate recirculation/gas recovery project that falls within the limitations established in this XL Agreement. Buncombe County is requesting specific flexibility under the current federal and state regulations for liquid addition to the landfill. Buncombe County is requesting that U.S. EPA grant site-specific regulatory flexibility from the prohibition in 40 CFR 258.28, Liquid Restrictions, which currently precludes the recirculation of leachate in Subtitle D landfill cells not constructed with the standard Subtitle D composite liner system. Buncombe County desires to construct the remainder of its landfill cells with an approved alternative liner while implementing this leachate recirculation/gas recovery project. Buncombe County is also requesting that U.S. EPA grant site-specific regulatory flexibility from the prohibition in 40 CFR 258.28, Liquid Restrictions, which currently precludes the addition of useful bulk or non-containerized liquid amendments. During periods of low leachate generation, Buncombe County desires to supplement the leachate flow with water from the adjoining French Broad River to maintain moisture levels in the landfill. Buncombe County requests that the State of North Carolina provide similar flexibility.

##### **B. Legal Implementing Mechanisms**

To implement this Project, the parties intend to take the following steps:

1. EPA expects to propose for public comment and promulgate a site-specific rule amending 40 CFR 258.28 for Buncombe County's Solid Waste Management Facility. This site-specific rule will describe the project requirements and any other aspects of the rulemaking. It is expected that the site-specific rule will provide for Withdrawal or Termination and a Post-Project Compliance Period consistent with Section VII, and will address the Transfer procedures included in Section X. The standards and reporting requirements set forth in Section II (and any attachments to this FPA) will be implemented in this site-specific rulemaking.

2. Requisite permits for each projected five year phase of the project constitute the State legal mechanisms for the XL project. Buncombe County will submit to the Division of Waste Management of the North Carolina Department of Environment and Natural Resources a permit application for the first five-year phase of the proposed leachate recirculation and gas collection system. As described in Section IV.B.2 of this Agreement, the Division will review the application in accordance with relevant law. Upon determination by the Division that the application meets all applicable requirements, the Division will issue a permit to construct, followed by a permit to operate, the leachate recirculation and gas collection system.
3. Except as provided in any rule(s), permit provisions or other implementing mechanisms that may be adopted to implement the Project, the parties do not intend that this FPA will modify or otherwise alter the applicability of existing or future laws or regulations to Buncombe County's Solid Waste Management Facility.
4. By signing this FPA, EPA, Buncombe County, the State of North Carolina Department of Environment and Natural Resources acknowledge and agree that they have the respective authorities and discretion to enter into this FPA and to implement the provisions of this project, to the extent appropriate.

## **V. Discussion of Intentions and Commitments for Implementing the Project**

### **A. Buncombe County's Intentions and Commitments**

Buncombe County proposes to operate, as specifically allowed by rulemaking and permitting procedures, its existing cells (Cells 1-3) and its future cells (Cells 4-10) near Asheville, North Carolina as a leachate recirculation/gas collection landfill to attain a number of superior environmental and cost savings benefits. The county is committed to working with federal, state, and local governments to demonstrate, with regulatory flexibility allowing recirculation over cells constructed with alternative liners and the addition of supplemental water (if needed), how a leachate recirculation/gas collection landfill can demonstrate more desirable environmental results than a conventional landfill. Further, the County is seeking possible delay in the closure rule requirements allowing it to continue to recirculate leachate even after a cell has reached its permitted final grade so that it may return and place additional waste when the expected settlement occurs.

### **B. EPA's and the State of North Carolina's Intentions and Commitments**

EPA intends to propose and issue (subject to applicable procedures and review of public

comments) a site-specific rule, amending 40 CFR Part 258.28 for Buncombe County to allow recirculation of leachate over cells constructed with an alternative liner and to allow the addition of supplemental water from the French Broad River should leachate availability become limited, that applies specifically to the Buncombe County Solid Waste Management Facility. The site-specific rule will also provide for withdrawal or termination and a post-Project compliance period consistent with Section XII of this Agreement, and will address the transfer procedures included in Section IX. The standards and reporting requirements set forth in Section V.E. will be implemented in the site-specific rule.

EPA will propose a site-specific rule to facilitate the implementation of this pilot project by providing regulatory flexibility for liquid additions into existing Cell 3, and future Cells 4 and 5. Based on periodic review of the pilot project the parties, in consultation with the stakeholders, determine that the pilot program is successfully exhibiting the superior environmental performance anticipated at this time and that no detrimental results (such as the alternative liner failing to perform as anticipated, or unsatisfactory performance of the gas collection or monitoring strategy) have been exhibited during the pilot project, then EPA may extend the regulatory flexibility described under this FPA to future cells at the Buncombe County project site. EPA will also take into account any relevant amendments to the regulations in 40 CFR Part 258 that concern addition of liquids to MSWLFs or landfill gas collection/ monitoring requirements. EPA expects that such amendments would supercede the site-specific rule and would apply to future landfill cells at the Buncombe site.

The Department of Environment and Natural Resources, Division of Waste Management, is the statutorily designated agency for permitting and regulation of municipal solid waste landfills in North Carolina. The Buncombe County landfill is currently operating under a permit to construct and a permit to operate the first five year phase3 of its municipal solid waste landfill facility with a projected total operational period of 34 years. Upon receipt of a permit application from Buncombe County for the first five year phase of the proposed leachate recirculation and gas recovery system at the landfill, the Division of Waste Management will review the application in accordance with applicable State statutes and rules and consistency with the site-specific rule promulgated by EPA for this XL project. If the Division determines that the application meets all of the applicable requirements, the Division will issue a permit to construct the first five-year phase of the project. A permit to operate will be issued following receipt and review of appropriate construction quality assurance and quality control documentation. Application for subsequent five-year phases of the project may be made to the Division for review in accordance with statutes and rules in effect at the time and the periodic assessment of the project performance described above.

### **C. Project XL Performance Targets**

The performance targets of this project will be to achieve the superior environmental performance described in Section III, G of this FPA in Table 2. It describes some of the measures that will be used. Others may be developed as part of the permitting processes and the associated stakeholder involvement.

### **D. Proposed Schedule and Milestones**

This project will be developed and implemented over a time period necessary to complete its desired major objectives, beginning from the date that the final legal mechanism becomes effective, unless it is terminated earlier or extended by agreement of all Project Signatories. Assuming that a Final Project Agreement is executed by October, 2000, the County intends to begin final design of the system and have it complete by the end of 2000. At that time, the appropriate permitting documents will be submitted to the State of North Carolina for permitting and to the USEPA for verification of consistency with the Final Project Agreement. It is expected that final permitting can be accomplished within six months at which time construction of the leachate recirculation/gas recovery system will commence. It is expected that the system will be operational by the beginning of 2002.

The current estimated build-out schedule for the Buncombe County Landfill is provided below. The actual schedule will depend mainly on the amount of waste received each year.

	<b>Opening Date</b>	<b>Expected Life</b>
<b>Cells 4-5</b>	Summer 2001	4.7 years
<b>Cell 6</b>	Winter 2006	5.6 years
<b>Cell 7</b>	Fall 2011	4.3 years
<b>Cell 8</b>	Fall 2015	4.1 years
<b>Cells 9-10</b>	Fall 2019	5.5 years

**E. Project Tracking, Reporting and Evaluation**

The project tracking, reporting and evaluation will be accomplished by the project sponsor in accordance with EPA requests. The County also agrees to provide periodic updates of project performance at nationally recognized solid waste symposiums, subject to acceptance by those symposia.

The County will prepare semi-annual reports which will include all monitoring data commencing with the execution of the Final Project Agreement and deliver them to USEPA and the stakeholders. An annual meeting will be held to review the project progress and results to date for as long as Buncombe County continues to recirculate leachate at its site under the provisions of the site specific rule(s) promulgated to implement this XL project.

**F. Periodic Review by the Parties to the Agreement**

The Parties will hold periodic performance review conferences to assess their progress in implementing this Project. Unless they agree otherwise, the date for those conferences will be concurrent with annual Stakeholder Meetings. No later than thirty (30) days following a periodic performance review conference, Buncombe County will provide a summary of the minutes of that conference to all Direct Stakeholders. Any additional comments of participating Stakeholders will be reported to EPA.

**G. Duration of the Project**

If the project, which is currently expected to cover Cells 1-5 at the facility, is deemed successful when evaluated against the expected superior results three years from the date of the Final Project Agreement, the County will request that they be able to expand the system to future cells under similar terms. This assumes that the current regulations for which the County is seeking flexibility are not changed in the meantime to allow the activities requested herein. In the event that EPA and North Carolina promulgate changes to the generally applicable requirements for leachate recirculation or landfill gas collection/ monitoring at municipal solid waste landfills like the Buncombe County landfill, and the stakeholders involved in this XL Project agree that no reason exists to have the project continue to be in effect, then this FPA may be terminated.

according to the procedures set forth within this document. The site specific rule mechanism(s) will contain a "sunset" provision ending authorization for this Project 25 years after the effective date of the final implementing mechanism(s). It will also address withdrawal or termination conditions and procedures (as described in Section XI). This Project will not extend past the agreed upon date, and Buncombe County will comply with all applicable requirements following this date (as described in Section XII), unless all parties agree to an amendment to the Project term (as provided in Section VIII).

The average duration for a conventional landfill with a geosynthetic membrane can be 20-50 years. The design life of the Buncombe County landfill is 35 years. The County proposes to conduct the bioreactor pilot over a period of twenty-five years. During that period, the County will to conduct specified monitoring at designated intervals during the life of the project. The data from the project monitoring will benefit EPA, State and local regulatory agencies, and will also be available to all other stakeholders who are interested in the environment, and safety at the site and in the project vicinity. The implementation of the pilot will be permissible through the promulgation of a site-specific rule. The County recognizes that the State permit will be valid for a period of five years. Prior to the the permit expiration, the site will be required to undergo an evaluation to ensure that there have been no instances of non-compliance, and to determine whether or not revisions need to be made to the permit prior to issuance of a new one. EPA evaluation would occur either during the same period of evaluation for the State permit review, or during the annual assessment for the project under the XL program.

If, during the 25 year period, EPA develops a new rule or rule modification addressing recirculation of leachate, Buncombe County and/or EPA could make the determination to cancel or terminate the pilot project and continue the recirculation consistent with the new regulations. At any point during the pilot project, if either party chooses to terminate the project, they may do so. However, it is expected that the implementation and operation of the bioreactor landfill site at Buncombe County will provide useful data in the for the evaluation of EPA rules as initiated by the April 6, 2000 Federal Register Notice (65FR, 18014).

## **VI. Legal Basis for the Project**

### **A. Authority to Enter into the Agreement**

By signing this Agreement, all signatories acknowledge and agree that they have the respective authorities, discretion, and resources to enter into this Agreement and to implement all applicable provisions of this Project, as described in this Agreement.

## **B. Legal Effect of the Agreement**

This Agreement states the intentions of the Parties with respect to Buncombe County's XL Project. The Parties have stated their intentions seriously and in good faith, and expect to carry out their stated intentions. This Agreement in itself does not create or modify legal rights or obligations, is not a contract or a regulatory action, such as a permit or a rule, and is not legally binding or enforceable against any Party. Rather, it expresses the plans and intentions of the Parties without making those plans and intentions binding requirements. This applies to the provisions of this Agreement that concern procedural as well as substantive matters. Thus, for example, the Agreement establishes procedures that the parties intend to follow with respect to dispute resolution and termination (see Sections X and XI). However, while the parties fully intend to adhere to these procedures, they are not legally obligated to do so.

EPA intends to propose for public comment a site-specific rule needed to implement this Project. Any rules, permit modifications or legal mechanisms that implement this Project will be effective and enforceable as provided under applicable law.

This Agreement is not a "final agency action" by EPA or the State, because it does not create or modify legal rights or obligations and is not legally enforceable. This Agreement itself is not subject to judicial review or enforcement. Nothing any Party does or does not do that deviates from a provision of this Agreement, or that is alleged to deviate from a provision of this Agreement, can serve as the basis for any claim for damages, compensation or other relief against any Party.

## **C. Other Laws or Regulations That May Apply**

Except as provided in the site specific rule for this Project, the parties do not intend that this Final Project Agreement will modify the applicability of any other existing or future laws or regulations.

## **D. Retention of Rights to Other Legal Remedies**

Nothing in this Agreement affects or limits Buncombe County's, EPA's, or the State of North Carolina's legal rights. These rights include legal, equitable, civil, criminal or administrative claims or other relief regarding the enforcement of present or future applicable federal and state laws, rules, regulations or permits with respect to the facility.



## **VII. Amendments or Modifications to the Agreement**

This Project is an experiment designed to test new approaches to environmental protection and there is a degree of uncertainty regarding the environmental benefits and costs associated with activities to be undertaken in this Project. Therefore, it may be appropriate to amend this Agreement at some point during its duration.

This Final Project Agreement may be amended by mutual agreement of all parties at any time during the duration of the Project. The parties recognize that amendments to this Agreement may also necessitate modification of legal implementation mechanisms or may require development of new implementation mechanisms. If the Agreement is amended, EPA and Buncombe County expect to work together with other regulatory bodies and stakeholders to identify and pursue any necessary modifications or additions to the implementation mechanisms in accordance with applicable procedures (including public notice and comment). If the parties agree to make a substantial amendment to this Agreement, the general public will receive notice of the amendment and be given an opportunity to participate in the process, as appropriate.

In determining whether to amend the Agreement, the parties will evaluate whether the proposed amendment meets Project XL acceptance criteria and any other relevant considerations agreed on by the parties. All parties to the Agreement will meet within ninety (90) days following submission of any amendment proposal (or within a shorter or longer period if all parties agree) to discuss evaluation of the proposed amendment. If all parties support the proposed amendment, the parties will (after appropriate stakeholder involvement) amend the Agreement.

## **VIII. Transfer of Project Benefits and Responsibilities to a New Owner**

The parties expect that the site specific rule will allow for a transfer of Buncombe County's benefits and responsibilities under the Project to any future owner or operator upon request of Buncombe County and the new owner or operator, provided that the following conditions are met

- A. Buncombe County will provide written notice of any such proposed transfer to the EPA, the State of North Carolina, and all applicable local agencies at least ninety (90) days before the effective date of the transfer. The notice is expected to include identification of the proposed new owner or operator, a description of its financial and technical capability to assume the obligations associated with the Project, and a statement of the new owner or operator's intention to take over the responsibilities in the XL Project of the existing owner or operator.

- B. Within forty-five (45) days of receipt of the written notice, the parties expect that EPA, the State of North Carolina, and all applicable local agencies in consultation with all stakeholders, will determine whether: (1) the new owner or operator has demonstrated adequate capability to meet EPA's requirements for carrying out the XL Project; (2) is willing to take over the responsibilities in the XL Project of the existing owner or operator; and, (3) is otherwise an appropriate Project XL partner. Other relevant factors, including the new owner or operator's record of compliance with Federal, State and local environmental requirements, may be considered as well. It is expected that the site specific rule will provide that, so long as the demonstration has been made to the satisfaction and unreviewable discretion of EPA, the State of North Carolina, and all applicable local agencies and upon consideration of other relevant factors, the FPA will be modified to allow the proposed transferee to assume the rights and obligations of Buncombe County. In the event that the transfer is disapproved by any agency, withdrawal or termination may be initiated, as provided in Section XI.

It will be necessary to modify the Agreement to reflect the new owner and it may also be necessary for EPA to amend appropriate rules (subject to applicable public notice and comment) to transfer the legal rights and obligations of Buncombe County under this Project to the proposed new owner or operator. The rights and obligations of this Project remain with Buncombe County prior to their final, legal transfer to the proposed transferee.

Landfill permits are not transferable in North Carolina. A proposed new owner of the landfill is required under State rules to obtain a new permit for the landfill.

## **IX. Process for Resolving Disputes**

Any dispute that arises under or with respect to this Agreement will be subject to informal negotiations between the parties to the Agreement. The period of informal negotiations will not exceed twenty (20) calendar days from the time the dispute is first documented, unless that period is extended by a written agreement of the parties to the dispute. The dispute will be considered documented when one party sends a written Notice of Dispute to the other parties.

If the parties cannot resolve a dispute through informal negotiations, the parties may invoke non-binding mediation by describing the dispute with a proposal for resolution in a letter to the Regional Administrator for EPA Region 4, with a copy to all parties. The Regional Administrator will serve as the non-binding mediator and may request an informal mediation meeting to attempt

to resolve the dispute. He or she will then issue a written opinion that will be non-binding and does not constitute a final EPA action. If this effort is not successful, the parties still have the option to terminate or withdraw from the Agreement, as set forth in Section XI below.

This dispute resolution process is not applicable to State permitting and enforcement actions.

## **X. Withdrawal From or Termination of the Agreement**

### **A. Expectations**

Although this Agreement is not legally binding and any party may withdraw from the Agreement at any time, it is the desire of the parties that it should remain in effect through the expected duration of 25 years, or until changes in generally applicable regulations make the requested flexibility unnecessary, or until the Subtitle D landfill portion of the BCSWMF reaches capacity, whichever occurs sooner. The agreement will be implemented as fully as possible, unless one of the conditions below occurs:

1. Failure by any party to: (a) comply with the provisions of the enforceable implementing mechanisms for this Project, or (b) act in accordance with the provisions of this Agreement. The assessment of the failure will take its nature and duration into account
2. Failure of any party to disclose material facts during development of the Agreement.
3. Failure of the Project to provide superior environmental performance consistent with the provisions of this Agreement.
4. Enactment or promulgation of any environmental, health or safety law or regulation after execution of the Agreement, which renders the Project legally, technically or economically impracticable.
5. Decision by an agency to reject the transfer of the Project to a new owner or operator of the facility.

Buncombe County will be given notice and a reasonable opportunity to remedy any substantial failure before EPA's withdrawal. If there is a disagreement between the parties over whether a substantial failure exists, the parties will use the dispute resolution mechanism identified in Section X of this Agreement. EPA, the State of North Carolina, and all applicable local agencies retain their discretion to use existing enforcement authorities, including withdrawal or termination of this Project, as appropriate. Buncombe County retains any existing rights or abilities to defend itself against any enforcement actions, in accordance with applicable procedures.

## **B. Procedures**

The parties agree that the following procedures will be used to withdraw from or terminate the Project before expiration of the Project term. They also agree that the implementing mechanism(s) will provide for withdrawal or termination consistent with these procedures.

1. Any party that wants to terminate or withdraw from the Project is expected to provide written notice to the other parties at least sixty (60) days before the withdrawal or termination.
2. If requested by any party during the sixty-(60) day period noted above, the dispute resolution proceedings described in this Agreement may be initiated to resolve any dispute relating to the intended withdrawal or termination. If, following any dispute resolution or informal discussion, a party still desires to withdraw or terminate, that party will provide written notice of final withdrawal or termination to the other parties.

If any agency withdraws or terminates its participation in the Agreement, the remaining agencies will consult with Buncombe County to determine whether the Agreement should be continued in a modified form, consistent with applicable federal or State law, or whether it should be terminated.

3. The procedures described in this Section apply only to the decision to withdraw or terminate participation in this Agreement. Procedures to be used in modifying or rescinding any legal implementing mechanisms will be governed by the terms of those legal mechanisms and applicable law. It may be necessary to invoke the implementing mechanism's provisions that end authorization for the Project (called "sunset provisions") in the event of withdrawal or termination.

## **XII. Compliance After the Project is Over**

The parties intend that there be an orderly return to compliance upon completion, withdrawal from, or termination of the Project, as follows:

### **A. Orderly Return to Compliance with Otherwise Applicable Regulations, if the Project Term is Completed**

Buncombe County is expected to anticipate and plan for all activities to return to compliance sufficiently in advance of the end of the Project term. Buncombe County may request a meeting with EPA, the State of North Carolina, and all applicable local agencies to discuss the timing and nature of any actions that they will be required to take. The parties should meet within thirty days of receipt of Buncombe County's written request for such a discussion. At and following such a meeting, the parties should discuss in reasonable, good faith, which of the requirements deferred under this Project will apply after termination of the Project.

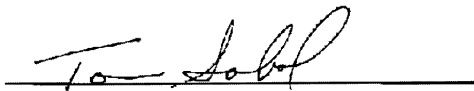
### **B. Orderly Return to Compliance with Otherwise Applicable Regulations in the Event of Early Withdrawal or Termination**

In the event of a withdrawal or termination not based on the end of the Project term and where Buncombe County has made efforts in good faith, the parties to the Agreement will determine an interim compliance period to provide sufficient time for Buncombe County to return to compliance with any regulations deferred under the Project. The interim compliance period will extend from the date on which EPA, the State of North Carolina, and all applicable local agencies provide written notice of final withdrawal or termination of the Project, in accordance with Section XI of this Project Agreement. By the end of the interim compliance period, Buncombe County will comply with the applicable deferred standards set forth in 40 CFR Part 258.28 and 40 CFR 258.60(f). During the interim compliance period, EPA, the State of North Carolina, and any applicable local agency may issue an order, permit, or other legally enforceable mechanism establishing a schedule for Buncombe County to return to compliance with otherwise applicable regulations as soon as practicable. This schedule cannot extend beyond 6 months from the date of withdrawal or termination. Buncombe County intends to be in compliance with all applicable Federal, State, and local requirements as soon as is practicable, as will be set forth in the new schedule.

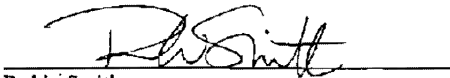
## **XII. Signatories and Effective Date**

A handwritten signature in black ink, appearing to read 'A. Stanley Meiburg', written over a horizontal line.

A. Stanley Meiburg, Deputy Regional Administrator  
EPA, Region 4

A handwritten signature in black ink, appearing to read 'C. Thomas Sobol', written over a horizontal line.

C. Thomas Sobol  
Chairman  
Buncombe County Board of Commissioners

A handwritten signature in black ink, appearing to read 'Robin Smith', written over a horizontal line.

Robin Smith  
Assistant Secretary for Environment  
North Carolina Department of the Environment and Natural Resources

### Supporting Signatories

The Buncombe County XL Project enjoys the support of a broad range of public and private organizations and individuals. The project incorporates both public/private and federal/local partnerships and will serve as an example that will benefit the economy, the community, and the environment.

Our signatures below express our support for this project and the contribution it will make to the environment and the community.

Signed: \_\_\_\_\_

*Alan T. H. Hengue*

Affiliation: \_\_\_\_\_

*WNC Regional Air Quality Agency*

# Appendix B



Buncombe County Solid Waste Management Facility  
Quarterly Explosive Gas Monitoring

	Scalehouse	Conv. Center	Garage	MMW #2	MMW #1	Trailer	Block Bldg	Office	HHW	Wellhouse
<b>2/23/2001</b>										
Oxygen	19.6%	19.1%	19.8%	19.0%	20.0%	19.8%	19.9%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>2/1/2002</b>										
Oxygen	19.8%	19.8%	19.9%	18.4%	19.9%	20.0%	20.0%	N/A	N/A	N/A
Methane	0.0%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	1.5%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>4/26/2002</b>										
Oxygen	19.8%	19.8%	19.9%	18.4%	19.9%	20.0%	20.0%	N/A	N/A	N/A
Methane	0.0%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>8/13/2002</b>										
Oxygen	19.7%	19.9%	19.9%	19.8%	19.9%	19.7%	19.8%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>4/8/2003</b>										
Oxygen	19.7%	19.6%	19.7%	19.8%	19.9%	19.7%	19.8%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>8/11/2003</b>										
Oxygen	19.8%	19.7%	19.8%	19.9%	19.6%	19.9%	19.8%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>12/3/2003</b>										
Oxygen	19.7%	19.6%	19.9%	19.3%	19.9%	19.8%	19.9%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>12/8/2003</b>										
Oxygen	19.6%	19.1%	19.7%	19.5%	19.8%	19.8%	19.7%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>3/16/2004</b>										
Oxygen	19.7%	19.3%	19.8%	19.7%	19.8%	19.8%	19.6%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>6/8/2004</b>										
Oxygen	19.5%	19.6%	19.6%	19.8%	19.7%	19.8%	19.5%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>9/1/2004</b>										
Oxygen	19.9%	19.8%	19.9%	19.8%	19.7%	19.7%	19.6%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>12/7/2004</b>										
Oxygen	19.5%	19.7%	19.6%	19.7%	19.5%	19.6%	19.5%	N/A	N/A	N/A
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
Carbon Dioxide	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A
<b>3/27/2008</b>										
Oxygen	20.60%	20.60%	20.70%	14.20%	20.10%	20.70%	20.80%	20.60%	20.90%	20.60%
Methane	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Carbon Dioxide	0%	0%	0%	4%	0.6%	0%	0%	0%	0%	0%
<b>6/30/2008</b>										
Oxygen	20.50%	20.50%	20.40%	16.70%	20.20%	20.30%	20.30%	20.40%	20.50%	20.60%
Methane	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Carbon Dioxide	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<b>9/22/2008</b>										
Oxygen	20.40%	20.50%	20.30%	16.60%	19.60%	20.50%	20.40%	20.40%	20.50%	20.50%
Methane	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Carbon Dioxide	0%	0%	0%	2.4%	0.4%	0%	0%	0%	0%	0%
<b>12/16/2008</b>										
Oxygen	20.60%	20.70%	20.50%	20.20%	19.50%	20.50%	20.50%	20.50%	20.80%	20.80%
Methane	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Carbon Dioxide	0%	0%	0%	0.2%	0.9%	0%	0%	0%	0%	0%
<b>3/9/2009</b>										
Oxygen	20.40%	20.60%	20.40%	20.60%	20.60%	20.40%	20.40%	20.50%	20.30%	20.60%
Methane	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Carbon Dioxide	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Buncombe County Solid Waste Management Facility  
Quarterly Explosive Gas Monitoring

	Scalehouse	Conv. Center	Garage	MMW #2	MMW #1	Trailer	Block Bldg	Office	HHW	Wellhouse
<b>6/1/2009</b>										
Oxygen	20.30%	20.10%	20.20%	19.80%	20.20%	20.10%	20.10%	20.20%	20.10%	20.30%
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Carbon Dioxide	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>9/23/2009</b>										
Oxygen	20.00%	19.80%	19.90%	18.30%	4.20%	19.80%	19.60%	19.90%	20.00%	19.80%
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Carbon Dioxide	0.0%	0.0%	0.0%	1.1%	10.7%	0.0%	0.0%	0.0%	0.0%	0.1%
<b>12/7/2009</b>										
Oxygen	19.80%	19.80%	19.90%	14.40%	19.10%	19.80%	19.90%	20.00%	19.90%	19.90%
Methane	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Carbon Dioxide	0.0%	0.1%	0.0%	3.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>3/29/2010</b>										
Oxygen	19.80%	19.70%	19.80%	18.70%	18.30%	19.70%	19.70%	19.70%	19.90%	19.80%
Methane	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Carbon Dioxide	0.0%	0.0%	0.0%	0.8%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>6/10/2010</b>										
Oxygen	20.40%	20.20%	20.20%	19.30%	19.80%	20.20%	20.00%	20.30%	20.30%	20.10%
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Carbon Dioxide	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>9/13/2010</b>										
Oxygen	20.10%	20.10%	20.00%	14.70%	17.40%	20.00%	19.90%	20.20%	19.80%	20.20%
Methane	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Carbon Dioxide	0.0%	0.0%	0.0%	12.2%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>12/29/2010</b>										
Oxygen	20.30%	20.40%	20.20%	20.10%	19.90%	20.20%	20.30%	20.10%	20.30%	20.40%
Methane	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%
Carbon Dioxide	0.0%	0.0%	0.0%	0.1%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%

Buncombe County Solid Waste Management Facility  
Subtitle D Landfill  
Buncombe Bioreactor  
Leachate Recirculated from 2006-2010

YEAR	MONTH	TOTAL GALLONS RECIRCULATED	Total into West Zone (HITs D,E,F & SGT's 1,2,3)	Total into North Zone (HITs A,B,C & SGT's 4,5)
2006	December	430,000	330,000	100000
2008	May	47,460	47460	
	June	32,770	32770	
	September	25,820	25820	
	October	57,730	57,730	
	November	97,830	83,110	14720
<b>2008 Total</b>		<b>261,610</b>	<b>246,890</b>	<b>14,720</b>
2009	April	16,890	10,220	6670
	July	84,850	24,450	60400
	August	23,530	23,530	
	December	45,760	22,520	23240
<b>2009 Total</b>		<b>171,030</b>	<b>80,720</b>	<b>90,310</b>
2010	April	293,000	86,000	207,000
	May	42,800	22,800	20,000
	June	248,800	160,400	88,400
	July	69,600	45,600	24,000
	November	47,200	47,200	
<b>2010 Total</b>		<b>701,400</b>	<b>362,000</b>	<b>339,400</b>
<b>Total Leachate Recirculated</b>		<b>1,564,040</b>	<b>1,019,610</b>	<b>544,430</b>

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Generation and Rainfall (Leachate Collection System)**

Date	Rain (inches)	Cell 1 (gallons)	Cell 2 (gallons)	Cell 3 (gallons)	Cell 4 (gallons)	Cell 5 (gallons)	Cell 6 (gallons)	Weekly Total (gallons)
11/13/2007	0.02	1,015	-	-	5,677	566	27,799	35,057
11/20/2007	0.89	2,795	-	11,385	-	2,028	351,253	367,461
11/28/2007	0.19	1,434	-	9	1	2,868	69,124	73,436
12/5/2007	0.11	1,184	-	-	5,704	1,092	35,391	43,371
12/12/2007	0.31	982	375	-	-	1,122	99,675	102,154
12/18/2007	0.52	554	16	-	-	1,042	166,337	167,949
12/27/2007	0.61	1,759	96	9,504	-	2,957	231,726	246,042
1/2/2008	1.24	1,747	93	-	3,391	3,377	368,811	377,419
1/7/2008	0.05	755	188	-	-	1,231	34,359	36,533
1/14/2008	0.86	2,577	344	-	-	5,579	287,507	296,007
1/24/2008	0.29	1,599	219	-	7,752	3,291	121,773	134,634
1/30/2008	0.2	704	164	9,241	-	1,958	42,290	54,357
2/1/2008	0.64	283	62	54	-	1,937	141,494	143,830
2/5/2008	0.58	2,185	575	-	-	7,974	-	10,734
2/13/2008	0.27	4,017	396	-	7,361	5,297	212,707	229,778
2/20/2008	0.82	1,906	276	9,512	-	7,329	297,974	316,997
2/29/2008	0.62	2,127	67	-	-	4,279	143,987	150,460
3/4/2008	2.11	1,099	14	-	52,129	14,615	131,403	199,260
3/14/2008	2.59	84,080	-	11,438	492,030	9,759	481,716	1,079,023
3/19/2008	0.76	124,256	-	-	5,078	7,575	248,035	384,944
3/26/2008	0.38	7,244	-	-	5,619	7,208	157,094	177,165
4/2/2008	0.39	4,440	-	-	2,757	2,406	94,525	104,128
4/9/2008	1.03	3,210	-	10	3,334	7,245	232,460	246,259
4/17/2008	0.16	35	152	578	156	-	66,345	67,266
4/23/2008	0.4	2,131	167	4	2,923	-	178,019	183,244
4/30/2008	0.7	2,093	256	-	2,825	2,427	111,200	118,801
5/7/2008	0.04	1,494	1,276	2	-	1,663	-	4,435
5/12/2008	0.6	923	-	9,374	2,378	1,767	190,822	205,264
5/22/2008	0.61	1,646	168	3,335	3,109	2,411	205,550	216,219
5/27/2008	0.09	760	119	211	99	866	22,003	24,058
5/29/2008	0.74	324	-	2	3,994	618	189,878	194,816
6/2/2008	0.16	546	102	3,371	5	766	31,552	36,342
6/10/2008	0	1,159	60	7	13	2,335	22,935	26,509
6/16/2008	0.8	880	-	3,465	2,924	2,017	455,984	465,270
6/25/2008	0.33	1,088	-	192	35	2,538	123,443	127,296
6/30/2008	1.58	1,065	-	2,650	3,111	1,602	386,737	395,165
7/9/2008	0.54	971	-	3	36	1,701	137,328	140,039
7/16/2008	1.75	1,239	52	2,950	3,946	4,080	664,111	676,378
7/23/2008	0.03	1,158	1	-	-	1,935	38,166	41,260
7/31/2008	0.47	1,316	2	150	3,372	1,911	148,956	155,707
8/7/2008	0.51	1,043	1	4	250	1,141	90,385	92,824
8/13/2008	0.13	890	2	3,486	3,117	826	19,254	27,575
8/20/2008	0.46	1,019	1	15	193	1,961	88,671	91,860
8/26/2008	1.05	853	1	5	2,643	-	124,645	128,147
8/27/2008	2.25	553	17	2,540	131,344	9,087	129,576	273,117
8/28/2008	0.89	571	7	195	223,248	3,820	92,276	320,117
9/3/2008	0.09	460	4	2,334	241,195	2,593	176,706	423,292
9/10/2008	0.53	3,281	3	2,762	12,868	1,521	287,350	307,785
9/24/2008	0.09	2,921	2	3,597	1,795	1,675	53,685	63,675
10/1/2008	0.2	1,977	2	-	2,478	978	24,638	30,073
10/8/2008	0.05	1,622	2	-	1,427	2,006	43,888	48,945
10/16/2008	0.39	1,836	300	7,887	10,679	-	110,125	130,827
10/27/2008	0.48	1,997	395	1,138	3,828	-	142,176	149,534

## Buncombe County Solid Waste Management Facility

## Subtitle D Landfill

## Leachate Generation and Rainfall (Leachate Collection System)

11/6/2008	0.03	1,620	335	3,302	1,904	1,872	26,290	35,323
11/12/2008	0.01	885	168	1,294	1,291	1,140	10,378	15,156
11/13/2008	0.54	131	835	3	-	-	49,763	50,732
11/19/2008	0.6	789	-	1,121	1,862	1,291	301,770	306,833
11/25/2008	0.04	839	185	1,946	1,150	1,009	22,273	27,402
12/3/2008	0.3	941	494	649	1,551	1,274	105,664	110,573
12/9/2008	0.03	673	165	1,332	1,147	531	18,091	21,939
12/12/2008	1.94	436	776	1,660	1,326	7,741	457,970	469,909
12/18/2008	0	977	-	1,557	483	1,914	229,872	234,803
12/23/2008	0.54	1,155	412	1,329	2,229	2,390	329,851	337,366
1/7/2009	1.99	2,779	1,857	7,255	3,648	21,686	470,469	507,694
1/14/2009	0.13	2,799	783	5,434	6,883	6,577	449,630	472,106
1/22/2009	0.04	2,780	332	1,969	2,221	2,053	201,161	210,516
1/29/2009	0.21	1,979	338	1,380	1,608	2,339	58,963	66,607
2/10/2009	0.15	3,022	451	1,871	2,137	2,743	51,999	62,223
2/18/2009	0.9	1,800	590	1,946	1,951	1,742	169,527	177,556
2/25/2009	0.09	1,370	59	2,235	1,367	1,888	61,140	68,059
3/3/2009	0.82	1,135	460	1,443	1,645	2,474	215,255	222,412
3/11/2009	0	1,572	497	1	1,762	208	10,344	14,384
3/16/2009	1.09	714	441	-	1,039	2	193,805	196,001
3/26/2009	0.45	1,309	186	3,567	1,627	565	102,322	109,576
4/1/2009	0.65	1,190	649	3,260	2,153	2,020	154,307	163,579
4/8/2009	0.38	1,063	546	2,754	-	2,824	99,824	107,011
4/13/2009	1.08	830	602	2,038	1,708	2,833	313,483	321,494
4/20/2009	0.88	1,293	884	2,290	1,837	3,989	223,560	233,853
4/29/2009	0.1	1,665	838	4,042	3,030	7,288	140,539	157,402
5/4/2009	0.6	952	447	2,056	506	1,595	140,560	146,116
5/7/2009	1.76	620	318	13	1,272	4,400	465,910	472,533
5/11/2009	1.09	1,075	711	2,379	1,957	4,182	385,501	395,805
5/15/2009	1.03	1,252	673	2,080	1,088	11,045	417,800	433,938
5/18/2009	1.05	1,601	830	2,832	22,815	10,309	262,835	301,222
5/26/2009	0.28	2,038	708	2,093	1,920	3,626	320,915	331,300
5/27/2009	0.72	717	354	383	612	3,821	208,743	214,630
6/3/2009	1.27	1,974	858	2,538	19,111	9,176	384,127	417,784
6/4/2009	0.71	476	274	387	651	1,028	174,880	177,696
6/10/2009	0.27	2,198	468	1,653	1,933	3,045	223,440	232,737
6/17/2009	0.68	2,939	1,580	2,193	1,852	3,350	271,160	283,074
6/23/2009	2.41	1,900	454	1,068	19,120	5,971	336,230	364,743
7/1/2009	0.35	2,738	633	3,074	5,750	3,285	581,276	596,756
7/8/2009	0.47	2,336	484	2,907	2,147	2,382	82,675	92,931
7/13/2009	0.71	1,601	478	1,863	1,232	1,464	143,379	150,017
7/23/2009	0.3	2,925	583	2,143	1,894	2,430	104,053	114,028
7/29/2009	1.52	1,798	450	1,165	2,067	1,751	359,897	367,128
8/5/2009	1.44	1,910	492	1,125	13,414	3,208	367,280	387,429
8/14/2009	1.84	2,367	550	1,535	2,249	6,035	752,930	765,666
8/20/2009	0.14	1,861	488	1,553	1,357	1,788	61,661	66,847
8/27/2009	1	1,832	261	1,148	2,074	1,697	254,588	261,600
9/2/2009	0.54	1,521	253	1,084	1,121	1,340	799	6,118
9/9/2009	0.05	1,760	464	600	1,917	1,898		6,639
9/17/2009	0.78	1,899	375	78	2,730	2,773	644,005	651,860
9/21/2009	1.37	1,031	395	920	559	4,665	424,377	431,947
9/30/2009	2.33	2,999	1,795	4,426	274,518	25,651	555,920	865,309
10/5/2009	0.57	1,636	453	1,206	3,172	2,825	337,221	346,513
10/13/2009	0.38	2,307	466		1,462	2,395	285,199	291,829
10/16/2009	0.74	648	364	1,712	691	4,217	277,721	285,353
10/21/2009	0.19	1,511	333	1,132	2,890	3,196	68,370	77,432
10/28/2009	1.08	2,389	431	2,479	1,955	9,719	299,064	316,037
11/2/2009	0.72	1,035	329	32		10,681	252,367	264,444

## Buncombe County Solid Waste Management Facility

## Subtitle D Landfill

## Leachate Generation and Rainfall (Leachate Collection System)

11/12/2009	2.38	3,187	1,482	2,154	10,378	33,787	362,393	413,381
11/18/2009	0.3	2,071	640	1,837	88,179	5,992	208,045	306,764
11/25/2009	0.37	2,629	772	629	62,841	4,860	273,660	345,391
12/3/2009	0.91	2,951	1,075	528	5,142	10,144	472,033	491,873
12/9/2009	1.68	2,244	722	964	1,510	16,858	240,863	263,161
12/17/2009	0.2	2,842	368	2,784	4,129	8,639	617,029	635,791
12/22/2009	0.68	1,812	1,348	34	3,748	9,283	39,335	55,560
12/28/2009	1.68	895	1,430	3,099	298,748	50,838	36,151	391,161
1/6/2010	0.1	3,498		226,935	432,852	11,247	56,855	731,387
1/15/2010	0	4,869		2,423	24,111	5,286	112,132	148,821
1/20/2010	0.82	1,603	13,996	2,507	76,615	10,806	240,875	346,402
1/25/2010	1.16	3,067	638	5,885	35,907		187,010	232,507
2/3/2010	0.96	5,960	652	9,106	78,861		646,295	740,874
2/11/2010	1.1	5,521	628	4,676	56,800		328,875	396,500
2/18/2010	0.19	8,135	522	6,666	61,765		301,970	379,058
2/24/2010	0.19	7,703	321	165	5,087		254,379	267,655
3/3/2010	0.38	8,202	224	1,987	3,090		39,201	52,704
3/10/2010	0.12	2,174	339	1,810	2,767		77,383	84,473
3/17/2010	1.14		374	2,184	2,855		292,943	298,356
3/25/2010	0.53	566	655	3,692	3,234	937	132,303	141,387
3/31/2010	0.52	3,726	663	1,834	2,501	5,023	88,497	102,244
4/7/2010	0.01	5,213	1,005	2,772	2,655	4,330	48,079	64,054
4/14/2010	1.18	4,723	700	978	3,398	11,048	416,340	437,187
4/22/2010	0.13	5,283	782	5	1,813	3,794	130,155	141,832
4/26/2010	0.77	2,836	348	92	1,302	1,653	106,740	112,971
5/3/2010	1.3	4,982	571	1,176	2,529	2,718	82,630	94,606
5/10/2010	0.15	5,313	503	1,544	2,694	4,119	340,174	354,347
5/18/2010	0.51	5,165	844	1,548	1,827	2,317	18,627	30,328
5/27/2010	0.57	5,199	590	42	2,682	2,422	23,236	34,171
6/1/2010	0.61	2,706	353	22	1,250	1,090	9,661	15,082
6/9/2010	1.01	4,131	558	15	2,773	2,035	106,683	116,195
6/16/2010	0.96	3,613	568	1,606	1,730	1,800	106,393	115,710
6/22/2010	0.02	2,989	275	57	1,229	1,269	18,109	23,928
6/30/2010	0.47	3,547	390	57	1,984	1,307	20,153	27,438
7/6/2010	0	2,553	405		1,465	1,155	13,257	18,835
7/14/2010	1.28	3,145	341		1,260	1,423	129,071	135,240
7/21/2010	1.75	2,520	574		1,815	3,852	394,491	403,252
7/29/2010	0.04	3,175	402		1,830	1,623	36,681	43,711
8/4/2010	1.3	2,186	263		1,310	2,435	254,856	261,050
8/11/2010	0.2	2,596	311		1,873	1,245	23,426	29,451
8/18/2010	1	2,663	311		1,292	1,388	187,572	193,226
8/23/2010	1.35	1,758	157		1,281	1,111	223,068	225,617
9/1/2010	0.16	3,345	408	252	1,988	1,728	54,982	62,703
9/9/2010	0.32	2,649	273	33		996	1,928	5,879
9/15/2010	0.73	2,446	317	198		780		3,741
9/22/2010	1.01	2,041	215				138,882	141,138
9/27/2010	1.5	1,666	214	57	40		53,799	55,776
10/6/2010	1.2	3,097	1,230	17			483,721	488,065
10/13/2010	0.36	2,416	144	14		1,284	34,642	38,500
10/26/2010	0.66	4,427	319	1,225	7,075	2,391		15,437
11/3/2010	0.66	2,799	205	13	2,311	161	34,402	39,891
11/12/2010	0.57	3,229	268	2,205	2,419	1,593	47,081	56,795
11/18/2010	0.35	1,855	194		1,515	1,580	14,123	19,267
12/1/2010	2.47	3,699	636		4,615	16,615	189,685	215,250
12/8/2010	0.37	2,377	404	68	1,307	3,653	481,396	489,205
12/15/2010	0.16	2,277		1	1,775		34,152	38,205
12/23/2010	0.28	2,446	446		2,702	4,044	51,703	61,341
12/29/2010	0.16	1,789	277		122	1,831	28,974	32,993

**Buncombe County Solid Waste Management Facility**

**Subtitle D Landfill**

**Leachate Generation and Rainfall (Leachate Collection System)**

1/5/2011	0.51	2,131	1,491	3	3,245	13,551	208,399	228,820
1/13/2011	0.37	2,290	324		3,679	4,005	29,464	39,762
1/21/2011	0.2	2,047	1,504		1,350	11,760	90,029	147,254
1/31/2011	0.33	2,874	822	2	2,953	5,236	89,170	101,057
2/9/2011	0.89	2,881	1,118	1	3,321	14,065	291,029	312,415



**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Parameter Results**  
**Cell 1**

Sample Date	Lab Parameter (unit)					On-site Testing Parameter (unit)						
	BOD5 Day (mg/L)	Conductance (µmho/cm)	COD (mg/L)	Ammonia (mg/L)	pH	Turbidity (NTU)	Conductance (S/m)	DO (mg/L)	Temp (C)	pH	ORP (mV)	TDS (g/L)
1/29/2007	280	6,000	270	240	6.88	130	0.66	11.7	16.3	6.90	-191	4.2
2/27/2007	150	4,500	370	270	7.08	--	--	--	--	--	--	--
3/27/2007	51	6,400	380	330	7.20	120	0.77	7.3	18.8	7.10	-203	4.9
4/27/2007	--	--	--	--	--	--	--	--	--	--	--	--
5/29/2007	1,200	7,000	560	300	7.10	240	0.78	12.2	26.4	6.80	-205	4.9
6/22/2007	180	6,600	530	330	6.90	430	0.76	14.7	19.9	7.00	-193	4.8
7/27/2007	540	5,900	1,100	220	6.86	--	--	--	--	--	--	--
8/24/2007	450	2,190	528	52	6.20	--	--	--	--	--	--	--
11/27/2007	892	6,470	414	250	6.90	12.5	--	--	16.2	6.88	-98	3.7
1/29/2008	960	6,550	319	264	6.90	29.60	5.42	3.49	14.81	7.11	-189	--
2/25/2008	427	4,490	190	177	6.80	6.95	4.33	5.41	17.81	6.95	-129	2.8
3/27/2008	558	3,210	104	104	6.20	77.4	2.87	9.04	16.84	6.74	-99	1.8
4/21/2008	184	3070	202	138	6.30	66.5	3.59	1.48	17.58	6.99	-151	2.3
5/28/2008	687	4,200	242	184	6.70	57	4.52	6.30	19.42	7.16	-148	3.20
6/23/2008	819	4,060	223	167	6.70	58.1	4.78	5.29	24.42	7.32	-154	3.10
7/29/2008	68	4060	214	191	6.70	76.9	4.81	9.45	22.73	7.31	-167	3.1
8/27/2008	462	5,060	204	189	6.90	62.2	4.66	4.41	24.75	7.35	-174	4.1
9/23/2008	510	2,940	175	130	6.50	111	5.67	4.57	20.4	7.24	-166	2.3
10/27/2008	--	4390	184	174	6.8	128	3.97	8.26	17.38	7.59	-158	2.5
11/20/2008	232	4940	235	202	6.9	252	4.61	9.49	15.94	7.38	-146	2.9
1/29/2009	54	4140	191	191	7.0	167	3.62	10.45	15.22	6.82	-140	2.3
2/17/2009	6.6	4030	159	172.00	6.7	213	3.58	10.94	14.41	7.35	-102	2.3
3/30/2009	73.7	3900	245	200.00	6	198	3.77	7.27	19.44	7.33	-111	2.5
4/23/2009	10.3	4090	195	205.00	6.9	363	4.22	5.5	20.87	7.55	-135	2.7
5/27/2009	26.4	3090	167	143.00	6.5	196	2.79	7.53	21.05	7.08	-104	1.8
6/30/2009	570	3420	199	144.00	7	250	3.69	5.26	21.03	7.04	-134	2.4
7/23/2009	20.5	3560	173	175.00	6.8	380	3.99	5.21	22.57	7.64	-170	2.6
8/24/2009	10.2	4570	207	198.00	6.8	319	4.09	8.11	21.56	6.93	-136	2.7
9/30/2009	13	4010	246	203	6.9	382	4.42	5.57	19.52	7.57	-187	2.8
10/26/2009	118	3950	224	217	6.9	339	4.41	6.7	18.18	7.59	-134	2.8
12/14/2009	4.8	3680	246	189	7.1	338	3.9	7.27	16.61	7.71	-145	2.5
3/8/2010	77.4	3440	1000	171	6.6	396	3.24	7.86	17.93	7.82	-148	2.1
6/23/2010												
9/23/2010	28.1	5820	320	248	7.1	-	5.45	9.52	22.67	8.55	-204	3.5
12/23/2010	8.6	5820	348	309	7.2	-	5.26	2.33	12.97	8.69	-30	3.3



**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Parameter Results**  
**Cell 2**

Sample Date	Lab Parameter (unit)					On-site Testing Parameter (unit)						
	BOD5 Day (mg/L)	Conductance (µmho/cm)	COD (mg/L)	Ammonia (mg/L)	pH	Turbidity (NTU)	Conductance (S/m)	DO (mg/L)	Temp (C)	pH	ORP (mV)	TDS (g/L)
1/29/2007	--	--	--	--	--	--	--	--	--	--	--	--
2/27/2007	--	--	--	--	--	--	--	--	--	--	--	--
3/27/2007	--	--	--	--	--	--	--	--	--	--	--	--
4/27/2007	--	--	--	--	--	--	--	--	--	--	--	--
5/29/2007	1,900	6,400	1,300	320	7.18	210	0.7	14.2	26.8	7.00	-234	4.4
6/22/2007	60	5,800	400	320	6.80	310	0.68	14.3	19.7	7.00	-208	4.3
7/27/2007	30	4,600	370	210	6.65	--	--	--	--	--	--	--
8/24/2007	780	4,240	295	173	6.60	--	--	--	--	--	--	--
11/27/2007	525	4,520	296	173	6.90	11.1	--	--	11.8	6.97	-287	2.7
1/29/2008	660	5,600	248	198	6.50	15	4.79	3.6	15.3	6.73	-101	
2/25/2008	--	--	--	--	--	--	--	--	--	--	--	--
3/27/2008	438	2,660	160	79.7	6.20	81.5	2.43	10.36	10.77	6.72	-94	1.6
4/21/2008	187	3370	202	129	6.10	67.8	3.80	5.45	14.95	6.77	-108	2.3
5/28/2008	507	3,250	267	141	6.30	63.9	4.35	5.4	21.22	7.17	-134	3
6/23/2008	579	2,890	261	167	6.40	79	3.96	4.49	23.52	8.36	-141	2.5
7/29/2008	110	3,040	209	136	6.40	77.5	3.68	6.42	25.3	7.14	-158	2.5
8/27/2008	321	3,760	172	132	6.50	76.50	3.7	6.48	22.73	6.96	-152	2.4
9/23/2008	570	3,370	209	139	6.50	82.8	3.76	5.20	22.98	7.15	-153	2.8
10/27/2008	--	3710	207	139	6.5	102	3.34	11.14	15.92	7.26	-130	2.1
11/20/2008	504	2550	206	111	6.6	132	2.95	10.37	11.24	7.45	-110	1.9
1/29/2009	60	3470	187	145	6.6	171	3.31	9.94	8.95	7.16	-83	2.1
2/17/2009	15.0	3510.0	178.0	137.0	6.6	192	3.26	10.66	16.4	7.12	-102	2.1
3/30/2009	57.3	3160.0	208.0	126.0	6.7	228	3.16	8.36	17.52	7.55	-127	2
4/23/2009	10.3	2900.0	183.0	131.0	6.6	314	3.3	6.57	21.23	7.47	-138	2.1
5/27/2009	23.4	3050.0	196.0	124.0	6.4	206	2.96	8.44	20.38	7.09	-106	1.9
6/30/2009	480.0	2990.0	182.0	110.0	6.7	177	2.88	5.63	26.52	6.72	-119	1.9
7/23/2009	32.6	2580.0	163.0	137.0	6.6	363	3.2	4.38	24.15	7.41	-155	2
8/24/2009	6.6	3200.0	164.0	123.0	6.6	255	2.92	6.24	26.48	7.22	-146	1.9
9/30/2009	10.6	2200.0	176.0	113.0	6.7	244	3.03	3.03	19.57	6.96	-109	1.9
10/26/2009	95.1	2980.0	178.0	149.0	6.7	288	3.1	7.33	17.79	7.33	-110	2
12/14/2009	7.2	2670.0	204.0	130.0	6.6	347	3.07	6.53	15.33	7.13	-141	2
3/8/2010	11.0	2960.0	338.0	131.0	6.6	445	2.88	6.5	18.18	7.98	-143	1.8
6/23/2010	7.0	4260.0	304.0	207.0	6.7	439	4.01	4.89	22.98	8.66	-203	2.6
9/23/2010	11.3	5510.0	350.0	236.0	6.9	543	5.21	5.82	22.18	8.76	-204	3.5
12/23/2010	8.6	6640.0	421.0	316.0	7.0	788	5.51	2.46	13.8	8.34	-83	3.4

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Parameter Results**  
**Cell 3**

Sample Date	Lab Parameter (unit)					On-site Testing Parameter (unit)						
	BOD5 Day (mg/L)	Conductance (µmho/cm)	COD (mg/L)	Ammonia (mg/L)	pH --	Turbidity (NTU)	Conductance (S/m)	DO (mg/L)	Temp (C)	pH --	ORP (mV)	TDS (g/L)
1/29/2007	4,400	11,000	--	370	6.16	330	1.2	8.5	19.4	6.15	-167	7
2/27/2007	4,000	5,700	1,900	280	6.78	--	--	--	--	--	--	--
3/27/2007	260	5,500	700	250	6.90	120	0.69	7.5	20.5	6.80	-195	4.3
4/27/2007	1,700	2,000	1,200	47	5.50	100	0.25	9.9	16.1	5.40	-141	1.7
5/29/2007	1,200	6,400	760	270	7.00	240	0.71	11.7	26.6	6.50	-197	4.5
6/22/2007	450	5,000	870	170	6.70	230	0.57	11.8	22.3	6.60	-204	3.6
7/27/2007	24	4,300	280	210	6.91	--	--	--	--	--	--	--
8/24/2007	720	3,680	330	158	6.70	--	--	--	--	--	--	--
11/27/2007	445	3,490	189	140	6.80	25	--	--	18.8	6.80	-42	2.2
1/29/2008	435	3,870	103	154	6.60	15.40	3.40	3.53	19.77	6.92	-154	
2/25/2008	184	1,390	190	48.4	6.30	39.80	1.25	4.91	20.80	6.58	-178	0.8
3/27/2008	558	2,350	309	88	6.50	126.00	2.2	7.50	13.86	6.96	-130	1.4
4/21/2008	190	1040	78	49.6	6.00	91.10	1.30	6.47	17.68	6.93	0	0.1
5/28/2008	215	1,370	68	55.4	6.20	75.10	1.36	4.85	27.95	7.10	-114	0.9
6/23/2008	116	476	74	51.1	5.70	45.70	0.849	5.34	28.77	7.07	-106	0.55
7/29/2008	56	3280	207	133.0	6.70	61.00	3.58	13.49	24.04	6.97	-158	2.3
8/27/2008	171	1,280	155	45.8	6.30	69.30	0.98	5.46	24.02	6.95	-135	0.6
9/23/2008	204	1,440	77	54.6	6.40	80.90	1.5	4.24	25.25	7.11	-153	1
10/27/2008	--	1570	74	51.4	6.2	98.00	1.44	8.38	17.97	7.42	-114	0.9
11/20/2008	29	1050	36	18	5.8	127.00	0.937	10.45	13.46	7.14	-65	0.6
1/29/2009	30	530	--	7.8	5.7	165	0.482	165.00	11.21	6.54	-138	0.31
2/17/2009	4.0	1590.0	74.5	45.9	6.4	176	1.45	11.02	12.85	7.06	-47	0.9
3/30/2009	36.8	966.0	68.2	26.5	6.9	315	0.931	5.72	17.85	6.94	-124	0.6
4/23/2009	3.1	2630.0	154.0	97.2	6.7	343	2.68	3.68	20.11	7.34	-114	1.7
5/27/2009	20.0	1230.0	94.9	49.2	6.3	201	1.19	8.34	23.14	6.58	-95	0.8
6/30/2009	480.0	2720.0	189.0	120.0	6.9	241	3.19	5.38	26.11	6.9	-124	2
7/23/2009	13.3	2930.0	169.0	134.0	6.8	294	3.26	3.9	25.28	7.5	-153	2.1
8/24/2009	6.6	3950.0	224.0	148.0	6.7	256	3.55	6.66	20.77	7.07	-104	2.4
9/30/2009	47.9	590.0	127.0	23.7	6.4	318	0.631	5.44	22.03	6.95	-108	0.41
10/26/2009	111.0	1730.0	133.0	70.2	6.6	283	1.86	6.24	20.36	7.45	-142	1.2
12/14/2009	6.0	2920.0	203.0	141.0	6.8	298	3.07	7.29	17.31	7.5	-138	2
3/8/2010	9.0	2810.0	147.0	110.0	6.5	371	2.71	7.41	19.01	7.66	-125	1.7
6/23/2010	365.0	3190.0	1570.0	120.0	6.4	561	3.09	4.07	31.72	8.25	-209	2
9/23/2010	23.3	6350.0	360.0	255.0	7.3	-	5.72	8.75	24.06	8.7	-28	3.6
12/23/2010	31.4	6480.0	407.0	287.0	7.1	841	5.24	1.87	14.26	8.63	-35	3.3

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Parameter Results**  
**Cell 4**

Sample Date	Lab Parameter (unit)					On-site Testing Parameter (unit)						
	BOD5 Day (mg/L)	Conductance (µmho/cm)	COD (mg/L)	Ammonia (mg/L)	pH --	Turbidity (NTU)	Conductance (S/m)	DO (mg/L)	Temp (C)	pH --	ORP (mV)	TDS (g/L)
1/29/2007	3,700	6,700	4,800	220	6.23	580	0.75	11.9	11.6	6.13	-181	4.7
2/27/2007	2,800	1,500	1,900	68	5.26	--	--	--	--	--	--	--
3/27/2007	1,800	1,900	2,500	37	5.30	100	0.25	9.9	16.1	5.40	-141	1.7
4/27/2007	4,000	3,600	2,500	94	5.40	420	1.50	8.3	21.8	7.30	-218	9
5/29/2007	2,400	2,900	2,100	72	5.36	210	0.33	14.2	23	5.10	-156	2.2
6/22/2007	660	2,300	990	79	6.50	360	0.31	11.7	23.1	6.50	-204	2
7/27/2007	240	2,000	470	73	6.41	--	0.25	4.8	23.1	5.90	-187	1.6
8/24/2007	510	2,390	127	92	6.60	--	--	--	--	--	--	--
11/27/2007	870	2,990	859	104	6.70	93.2	--	--	14.4	6.80	-115	1.9
1/29/2008	415	2,420	228	88	6.40	50	2.35	0.0	10.2	6.88	-197	
2/25/2008	397	1,800	408	61.5	6.40	29.5	1.61	5.38	17.7	6.50	-191	1
3/27/2008	738	2,560	391	86	6.40	116	2.23	9.48	13.42	6.90	-126	1.4
4/21/2008	193	1080	86.7	45	6.10	83.8	1.36	7.37	16.29	7.08	0	0.1
5/28/2008	137	774	ND	16.4	5.70	65.9	7.34	6.17	23.01	7.34	-86	0.45
6/23/2008	86	552	43	19.2	5.80	47.6	0.616	4.33	32.16	6.78	-89	0.4
7/29/2008	38	252	25	6.7	5.60	54	0.287	15.07	29.88	7.13	-162	0.18
8/27/2008	231	1,540	276	--	6.60	74.6	1.41	7.65	20.67	6.85	-149	0.9
9/23/2008	390	1,840	120	87.6	6.50	96.3	3.06	5.84	25.49	7.30	-149	4.1
10/27/2008	--	503	26	9.5	5.50	109	0.481	8.01	18.39	7.6	-77	0.32
11/20/2008	35	1050	38	18.6	5.8	140	0.918	13.15	14.06	7.01	-1	0.58
1/29/2009	42	1550	108	48.2	6.2	170	1.32	2.25	11.84	6.81	-204	0.9
2/17/2009	31.8	7980.0	972.0	430.0	7.4	201	6.9	11.1	15.81	7.41	-127	4.3
3/30/2009	61.3	5360.0	1580.0	293.0	5.9	302	3.18	6.58	18.65	7.12	-145	2
4/23/2009	51.7	7130.0	951.0	416.0	7.2	303	7.43	6.26	24	7.95	-129	4.7
5/27/2009	74.1	5000.0	666.0	335.0	7.1	259	5.28	6.96	22.62	7.67	-83	3.3
6/30/2009	1230.0	4720.0	556.0	282.0	7.1	310	4.86	5.53	23.65	7.37	-155	3.1
7/23/2009	42.2	6670.0	778.0	434.0	7.2	363	6.63	5.27	25.27	7.64	-184	4.2
8/24/2009	28.2	6700.0	814.0	339.0	7.0	-	0.172	-	-	9.09	-	-
9/30/2009	53.9	430.0	113.0	12.2	6.2	295	0.464	4.88	21.79	6.75	-137	2.2
10/26/2009	128.0	3740.0	542.0	253.0	7.0	314	4.41	5.87	21.23	7.82	-185	2.8
12/14/2009	30.0	3020.0	324.0	189.0	7.0	385	3.32	5.41	19.79	7.83	-155	2.1
3/8/2010	61.5	3550.0	362.0	130.0	6.7	419	3.37	7.68	18.97	7.16	-103	2.2
6/23/2010	35.3	7070.0	879.0	388.0	7.0	590	6.32	6.74	23.8	8.06	-234	3.13
9/23/2010	50.6	5330.0	632.0	230.0	6.9	823	5.02	7.57	25.96	8.59	-195	3.2
12/23/2010	24.2	8470.0	983.0	413.0	7.2	936	6.09	1.53	13.98	8.89	-155	3.8

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Parameter Results**  
**Cell 5**

Sample Date	Lab Parameter (unit)					On-site Testing Parameter (unit)						
	BOD5 Day (mg/L)	Conductance (µmho/cm)	COD (mg/L)	Ammonia (mg/L)	pH	Turbidity (NTU)	Conductance (S/m)	DO (mg/L)	Temp (C)	pH	ORP (mV)	TDS (g/L)
1/29/2007	650	11,000	880	580	7.30	300	1.20	6.5	22.0	7.18	-219	8.0
2/27/2007	30	1,500	1,400	730	7.48	--	--	--	--	--	--	--
3/27/2007	110	12,000	800	750	7.30	420	1.50	8.3	21.8	7.30	-218	9.0
4/27/2007	3,400	14,000	1,200	--	7.20	88	0.32	7.1	16.6	5.50	-143	2.0
5/29/2007	2,800	12,000	130	720	7.37	180	1.50	13.3	27.6	7.30	-203	9.0
6/22/2007	70	14,000	1,300	820	7.50	330	1.50	11.6	25.8	7.60	-124	10.0
7/27/2007	50	8,200	820	430	7.37	--	--	--	--	--	--	--
8/24/2007	1,980	6,690	1,060	668	6.90	--	--	--	--	--	--	--
11/27/2007	2,370	12,300	1,170	684	7.50	10	--	--	20.9	7.20	-158	7.0
1/29/2008	1380	8,940	726	445	7.00	10.50	7.51	4.36	13.86	7.18	-126.00	
2/25/2008	478	5,430	495	247	7.00	23.10	5.58	14.31	15.23	7.06	-126.00	3.50
3/27/2008	978	4,580	385	211	6.70	90.50	4.09	8.95	17.09	7.18	-117.00	2.60
4/21/2008	193	4890	517	272	6.80	105.00	5.25	6.19	20.99	6.91	-146.00	3.30
5/28/2008	1,560	7,130	689	362	7.10	69.70	9.99	4.22	26.84	7.47	-179.00	6.70
6/23/2008	1,540	6,420	740	367	7.00	163.00	7.28	6.50	33.98	7.74	-151.00	4.60
7/29/2008	158	6,870	771	430	7.20	129.00	7.32	6.03	35.24	7.52	-178.00	4.60
8/27/2008	366	3,400	304	154	6.80	73.60	3.42	4.94	28.57	7.37	-162.00	2.20
9/23/2008	1,560	7,240	733	406	6.50	143.00	7.05	5.12	29.42	7.82	-189.00	4.70
10/27/2008	42	11,200	1,030	666	7.40	217.00	9.38	9.41	22.43	8.03	-180.00	6.10
11/20/2008	131	10400	984	610	7.2	352.00	9.01	13.43	17.86	8.04	-164.00	5.60
1/29/2009	84	7850	755	396	7.2	327.00	6.91	10.19	16.80	7.66	-172.00	4.40
2/17/2009	40.2	10700.0	1070.0	601.0	7.4	242.00	9.26	8.59	21.62	7.84	-155.00	5.90
3/30/2009	75.9	1890.0	201.0	41.3	6.4	237	1.85	8.05	21.39	7.15	-128	1.2
4/23/2009	51.1	3200.0	377.0	178.0	6.8	316	3.57	5.89	24.71	7.45	-148	2.3
5/27/2009	166.0	1820.0	416.0	79.3	6.3	223	1.86	8.64	21.55	7.31	-98	1.2
6/30/2009	960.0	4610.0	404.0	231.0	7.1	253	4.42	5.31	24.2	7.22	-147	2.8
7/23/2009	67.9	9180.0	924.0	549.0	7.3	304	8.82	7.61	26.68	7.62	-161	5.7
8/24/2009	37.8	8080.0	760.0	380.0	7.1	363	6.99	6.36	26.16	7.54	-191	4.6
9/30/2009	16.8	2470.0	324.0	196.0	6.7	252	3.44	2.46	21.69	7.13	-134	2.2
10/26/2009	98.5	3840.0	441.0	238.0	6.9	286	4.7	4.72	20.75	7.05	-150	3
12/14/2009	16.8	3660.0	399.0	211.0	7.4	397	4.05	6.43	18.72	7.45	-165	2.6
3/8/2010	26.6	4280.0	365.0	215.0	6.8	422	4.02	5.95	20.8	8	-164	2.6
6/23/2010	37.7	10300.0	1050.0	545.0	7.2	405	9.15	1.82	25.56	8.95	-249	5.8
9/23/2010	38.6	6990.0	640.0	323.0	7.0	557	6.19	3.23	25.6	7.5	-205	3.9
12/23/2010	37.4	8200.0	744.0	389.0	7.1	966	6.79	3.82	18.33	8.74	-183	4.2

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Parameter Results-2008**  
**Cell 6**

Sample Date	Lab Parameter (unit)					On-site Testing Parameter (unit)						
	BOD5 Day (mg/L)	Conductance (µmho/cm)	COD (mg/L)	Ammonia (mg/L)	pH	Turbidity (NTU)	Conductance (S/m)	DO (mg/L)	Temp (C)	pH	ORP (mV)	TDS (g/L)
1/29/2008	--	--	--	--	--	--	--	--	--	--	--	--
2/25/2008	417.00	1680.00	404.00	55.60	6.30	24.80	1.64	7.90	17.20	6.50	-217.00	1.10
3/27/2008	438.00	1980.00	281.00	65.70	6.40	261.00	1.74	10.68	13.64	7.05	-125.00	1.10
4/21/2008	30.60	505.00	43.00	12.90	5.30	148.00	0.61	5.25	18.81	6.73	0.00	0.00
5/28/2008	68.70	443.00	52.00	16.00	6.50	61.70	0.47	4.36	21.06	6.95	-82.00	0.32
6/23/2008	48.90	479.00	30.00	11.60	5.60	51.90	0.46	7.27	25.62	7.13	-40.00	0.32
7/29/2008	7.40	127.00	--	1.30	5.20	55.40	0.18	2.54	26.24	6.09	-110.00	0.11
8/27/2008	63.00	281.00	37.00	2.00	5.40	78.90	0.278	4.35	24.14	6.21	-94.00	0.18
9/23/2008	70.50	1580.00	98.00	72.30	6.40	90.50	1.61	5.99	24.66	7.11	-146.00	5.40
10/27/2008	--	580.00	37.00	13.00	5.50	122	0.58	4.51	19.75	7.21	-39.00	0.37
11/20/2008	61	1080	38	23.8	5.9	160	0.979	17.32	16.31	6.66	55	0.62
1/29/2009	8.4	543	--	3.3	5.4	192	0.478	10.01	13.46	6.6	-20	0.31
2/17/2009	3.0	920.0	36.2	16.5	6.0	202	0.789	10.72	16.03	7.13	120	0.5
3/30/2009	27.0	922.0	51.4	23.9	7.7	380	0.918	3.69	19.14	6.48	-151	0.58
4/23/2009	--	730.0	48.2	11.3	5.5	304	0.721	2.29	21.69	6.56	53	0.46
5/27/2009	8.0	1150.0	66.9	3.3	4.4	234	1.75	8.1	22.49	6.96	10	1.1
6/30/2009	140.0	1380.0	86.7	54.9	6.4	232	1.34	5.53	20.7	7.76	-137	0.9
7/23/2009	10.9	1040.0	48.1	27.3	6.1	246	1.04	5.73	24.14	6.8	-97	0.7
8/24/2009	5.1	885.0	55.3	9.6	5.6	259	0.773	1.87	24.58	6.14	-42	0.5
9/30/2009	46.6	430.0	111.0	11.5	6.2	291	0.463	6.07	21.96	6.89	-153	0.3
10/26/2009	51.7	953.0	169.0	30.8	6.3	286	1.09	5.91	20.4	7.45	-155	0.7
12/14/2009	1980.0	1680.0	2040.0	29.6	5.4	684	1.85	1.38	17.34	6.26	-112	1.2
3/8/2010	1240.0	2270.0	1730.0	58.2	5.9	535	2.23	6.91	17.04	7.07	-59	1.4
6/23/2010	1430.0	3350.0	2510.0	122.0	6.2	653	3.4	6.24	24.5	7.81	-150	2.2
9/23/2010	486.0	1570.0	750.0	42.5	6.2	981	1.61	8.44	25.25	8.45	-95	1
12/23/2010	66.0	2590.0	463.0	83.7	6.6	999	2.15	1.95	15.6	8.75	-139	1.4

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leachate Parameter Results**  
**Leachate Pond**

Sample Date	Lab Parameter (unit)					On-site Testing Parameter (unit)						
	BOD5 Day (mg/L)	Conductance (µmho/cm)	COD (mg/L)	Ammonia (mg/L)	pH --	Turbidity (NTU)	Conductance (S/m)	DO (mg/L)	Temp (C)	pH --	ORP (mV)	TDS (g/L)
1/29/2007	2,700	2,900	3,800	43	5.24	140	0.34	12.3	7.5	5.50	--	2.2
2/27/2007	3,500	2,000	2,000	46	5.37	--	--	--	--	--	--	--
3/27/2007	2,200	2,400	2,500	49	5.40	88	0.32	7.1	16.6	5.50	-143	2.0
4/27/2007	2,900	2,900	2,500	66	5.70	88	0.32	7.1	16.6	5.50	-143	2.0
5/29/2007	2,400	2,800	2,200	84	5.96	260	0.37	10.6	32.0	6.05	-157	2.3
6/22/2007	960	4,200	1,500	150	6.90	360	0.51	11.8	23.8	7.10	-274	3.2
7/27/2007	600	2,900	1,300	100	7.98	--	--	--	--	--	--	--
8/24/2007	2,160	2,130	2,210	64	6.80	--	--	--	--	--	--	--
11/27/2007	848	1,860	1,150	68	7.00	130	208	5,150	9.9	7.30	-106	1.3
1/29/2008	110	1390	--	47.1	6.9	152	1.26	3.34	8.14	7.09	-60	
2/25/2008	247	1510	242	50	6.80	72.90	1.47	7.26	14.74	6.91	-113.00	1.00
3/27/2008	618	1630	488	51	6.60	171.00	1.57	12.70	12.04	7.03	-73.00	1.00
4/21/2008	178.00	1440.00	269.00	66.20	6.90	131.00	1.78	2.94	15.59	7.52	0.00	0.10
5/28/2008	131.00	874.00	54.00	33.80	7.10	103.00	0.84	12.42	21.91	7.46	40.00	0.55
6/23/2008	134.00	771.00	90.00	34.00	7.30	112.00	0.87	10.89	29.54	7.33	-50.00	0.56
7/29/2008	79.80	735.00	77.00	27.80	6.90	105.00	0.75	17.37	31.34	7.25	27.00	0.49
8/27/2008	69.00	1020.00	70.00	34.80	7.30	134.00	0.873	9.17	27.04	7.23	-79.00	0.58
9/23/2008	192.00	1300.00	272.00	54.70	7.00	199.00	1.34	1.32	21.20	7.02	-206.00	0.90
10/27/2008	--	1310	67	51	7.4	153	1.19	13.39	12.57	7.79	-119	0.8
11/20/2008	74	1040	52	38.7	7.3	281	1.02	17.32	8.13	7.9	-48	0.7
1/29/2009	42	1,360	62	40	7.0	464	1.3	15.2	7.83	7.39	-31	0.8
2/17/2009	9.0	1290.0	63.2	38.4	7.4	389	1.2	19.95	11.66	7.68	-21	0.8
3/30/2009	63.0	978.0	51.6	27.3	6.5	324	1	10.03	17.81	7.45	-74	0.6
4/23/2009	--	771.0	32.2	18.2	7.0	424	0.784	8.81	22.34	7.97	-27	0.5
5/27/2009	--	695.0	68.9	24.6	6.5	277	0.682	6.95	24.92	7.31	-36	0.44
6/30/2009	102.0	1100.0	64.0	26.0	6.9	256	1.05	6.69	25.97	6.81	36	0.7
7/23/2009	--	1140.0	50.8	31.3	7.4	318	1.16	7.04	28.77	8.03	45	0.7
8/24/2009	27.0	962.0	91.2	25.4	7.3	267	0.853	8.62	28.47	7.92	51	0.54
9/30/2009	10.8	716.0	73.0	27.0	7.0	284	0.789	4.2	19.75	7.12	-41	0.5
10/26/2009	119.0	721.0	46.0	29.7	7.6	371	0.825	8.91	16.54	8.08	8	0.53
12/14/2009	336.0	1280.0	704.0	27.2	6.2	465	1.44	8.55	10.2	7.66	-109	0.9
3/8/2010	259.0	1640.0	438.0	44.8	6.9	563	1.6	10.24	13.56	8.41	-118	1
6/23/2010												
9/23/2010	260.0	1380.0	480.0	32.7	6.8	634	1.26	6.11	22.25	8.29	-149	0.8
12/23/2010	103.0	1830.0	355.0	59.2	7.2	999	1.61	2.41	5.13	9.16	-91	1

**Buncombe County Solid Waste Management Facility  
Subtitle D Landfill  
Leachate Generated at the Leak Detection System**

Sample Date	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6	Total	Cumulative volume
	(gallons)	(gallons)	(gallons)	(gallons)	(gallons)	(gallons)	(gallons)	(gallons)
12/12/2007	0	0	427	0	0	340	767	767
1/29/2008								767
2/20/2008	0	0	800			1050	1850	2617
3/25/2008	0	0	325	25	175	2150	2675	5292
4/23/2008	0	0	100	0	150	775	1025	6317
5/29/2008	0	0	375	0	175	800	1350	7667
6/23/2008	0	0	330			850	1180	8847
8/1/2008	0	0	100	0	250	950	1300	10147
8/26/2008	0	0	100	0	400	800	1300	11447
9/24/2008	0	0	200	0	0	775	975	12422
10/30/2008	0	0	300	0	500	800	1600	14022
11/25/2008	0	0	275	0	625	800	1700	15722
12/19/2008	0	0	200	0	650	725	1575	17297
1/30/2009	0	0	200	0	300	650	1150	18447
2/17/2009	0	0	150	0	200	400	750	19197
4/30/2009	0	0	200	0	225	450	875	20072
5/1/2009	0	0	150	0	375	475	1000	21072
6/23/2009	0	0	100	0	200	625	925	21997
7/23/2009	0	0	100	0	350	700	1150	23147
8/25/2009	0	0	100	0	325	700	1125	24272
10/29/2009	0	0	150	0	400	550	1100	25372
11/19/2009	0	0	100	0	450	475	1025	26397
12/31/2009	0	0	125	0	475	475	1075	27472
1/25/2010	0	0	125	0	500	350	975	28447
2/23/2010	0	0	100	0	500	300	900	29347
3/23/2010	0	0	100	0	500	340.00	940	30287
4/21/2010	0	0	80	0	900	320.00	1300	31587
5/27/2010	0	0	100	0	600	300.00	1000	32587
6/23/2010	0	0	75	0	475	300.00	850	33437
7/29/2010	0	0	100	0	490	300.00	890	34327
8/23/2010	0	0	75	0	500	300.00	875	35202
9/29/2010	0	0	100	0	550	350.00	1000	36202
10/27/2010	0	0	75	0	500	325.00	900	37102
11/16/2010	0	0	50	0	525	350.00	925	38027
12/23/2010	0	0	60	0	425	300.00	785	38812



**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leak Detection Zone Sampling**  
**Cell 1**

Sample Date	Vol Collected (gal) <sup>1</sup>	On-site Testing Parameter (unit)						
		pH	Turb (NTU)	DO (g/L)	Temp C	TDS (g/L)	Cond. (S/cm)	ORP (mV)
12/12/2007	N/A	5.59	27.50	5.49	16.80	-	0.15	167
1/29/2008	N/A	5.71	171.00	4.10	16.53	-	0.18	216
2/20/2008	N/A	5.64	64.20	6.06	17.05	-	0.17	137
3/25/2008	N/A	6.31	236.00	6.34	14.79	0.13	0.20	165
4/23/2008	N/A	5.86	298.00	5.16	17.05	0.12	0.19	182
5/29/2008	-	-	-	-	-	-	-	-
6/23/2008	-	-	-	-	-	-	-	-
8/1/2008	-	-	-	-	-	-	-	-
8/26/2008	N/A	6.88	546.00	4.16	18.75	0.11	0.17	110
9/24/2008	N/A	7.60	218.00	7.73	16.90	0.11	0.18	72
10/30/2008	N/A	6.80	146.00	7.81	16.4	0.1	0.148	94
11/25/2008	N/A	6.46	215.00	5.32	17.19	0.11	0.172	274
12/19/2008	N/A	6.72	137.00	4.64	17.58	0.12	0.179	139
1/30/2009	N/A	6.33	160.00	2.83	16.44	0.13	0.19	206
2/17/2009	N/A	6.01	190	2.54	17.07	0.11	0.169	226
3/21/2009	N/A	6.97	380	5.59	12.38	0.12	0.187	118
4/30/2009	N/A	8.41	372	9.17	16.74	0.12	0.191	93
5/1/2009	-	-	-	-	-	-	-	-
6/23/2009	N/A	6.13	357	7.27	18.56	0.11	0.179	270
7/23/2009	-	-	-	-	-	-	-	-
8/25/2009	N/A	6.32	501	3.61	17.78	0.12	0.193	161
9/30/2009	see note	6.68	351	5.86	19.1	0.1	0.149	63
10/29/2009	N/A	7.19	454	4.74	18.01	0.14	0.216	122
11/19/2009	N/A	6.95	462	3.69	17.04	0.1	0.192	255
12/31/2009	-	-	-	-	-	-	-	-
1/25/2010	N/A	6.61	538	6.14	14.47	0.13	0.2	399
2/23/2010	N/A	6.99	464	6.02	14.32	0.16	0.189	296
3/23/2010	-	6.97	408	7.71	15.96	0.08	0.12	381
4/21/2010								
5/27/2010	-	6.91	462	6.31	19.76	0.09	0.141	138
6/23/2010	-	6.88	-	4.8	20.58	0.09	0.136	143
7/29/2010	-	7.45	966	5.8	20.96	0.09	0.129	147
8/23/2010	-	6.69	835	7.68	18.3	0.1	0.158	252
9/29/2010	-	7	947	7.74	17.07	0.09	0.133	118
10/27/2010	-	6.96	753	6.22	20.05	0.09	0.136	383
11/16/2010	-	7.86	651	7.49	18.73	0.1	0.144	393
12/23/2010	-	7.13	609	3.7	16.6	0.09	0.141	110

1 - Buncombe County monitors the natural spring under Cell 1 for water quality.



**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leak Detection Zone Sampling**  
**Cell 2**

Sample Date	Vol Collected (gal)	On-site Testing Parameter (unit)						
		pH	Turb (NTU)	DO (g/L)	Temp C	TDS (g/L)	Cond. (S/cm)	ORP (mV)
12/12/2007	-	-	-	-	-	-	-	-
1/29/2008	-	-	-	-	-	-	-	-
2/20/2008	-	-	-	-	-	-	-	-
3/25/2008	-	-	-	-	-	-	-	-
4/23/2008	-	-	-	-	-	-	-	-
5/29/2008	-	-	-	-	-	-	-	-
6/23/2008	-	-	-	-	-	-	-	-
8/1/2008	-	-	-	-	-	-	-	-
8/26/2008	-	-	-	-	-	-	-	-
9/24/2008	-	-	-	-	-	-	-	-
10/30/2008	-	-	-	-	-	-	-	-
11/25/2008	-	-	-	-	-	-	-	-
12/19/2008	-	-	-	-	-	-	-	-
1/30/2009	-	-	-	-	-	-	-	-
2/17/2009	-	-	-	-	-	-	-	-
3/21/2009	-	-	-	-	-	-	-	-
4/30/2009	-	-	-	-	-	-	-	-
5/1/2009	-	-	-	-	-	-	-	-
6/23/2009	-	-	-	-	-	-	-	-
7/23/2009	-	-	-	-	-	-	-	-
8/25/2009	-	-	-	-	-	-	-	-
9/30/2009	-	-	-	-	-	-	-	-
10/29/2009	-	-	-	-	-	-	-	-
11/19/2009	-	-	-	-	-	-	-	-
12/31/2009	N/A	6.91	776	3.47	13.88	0.24	0.373	293
1/25/2010	N/A	6.68	475	7.37	12.1	0.2	0.305	482
2/23/2010	N/A	6.8	435	7.22	14.06	0.18	0.278	439
3/23/2010	-	7.32	474	9.16	11.34	0.15	0.23	382
4/21/2010	-	-	-	-	-	-	-	-
5/27/2010	-	-	-	-	-	-	-	-
6/23/2010	-	7.42	841	6.53	21.3	0.19	0.298	17
7/29/2010	-	7.25	999	5.8	20.96	0.09	0.129	147
8/23/2010	-	6.74	762	7.16	20.05	0.18	0.271	42
9/29/2010	-	7	873	7.92	17.03	0.2	0.306	54
10/27/2010	-	7.07	737	7.59	19.18	0.18	0.268	84
11/16/2010	-	7.62	684	7.98	17.18	0.19	0.293	212
12/23/2010	-	7.2	732	3.43	14.72	0.2	0.306	150

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leak Detection Zone Sampling**  
**Cell 3**

Sample Date	Vol Collected (gal)	On-site Testing Parameter (unit)						
		pH	Turb (NTU)	DO (g/L)	Temp C	TDS (g/L)	Cond. (S/cm)	ORP (mV)
12/12/2007	427	6.83	0.41	1.56	15.13	-	0.413	-71
1/29/2008	0	-	-	-	-	-	-	-
2/20/2008	800	6.33	18	7.78	16.6	-	0.269	62
3/25/2008	325	6.40	31.50	5.68	17.23	0.18	0.29	389.00
4/23/2008	100	6.79	114.00	8.62	19.26	0.15	0.22	384.00
5/29/2008	375	7.08	140.00	3.35	18.23	0.21	0.32	-60.00
6/23/2008	330	7.34	53.60	6.19	25.34	0.15	0.24	203.00
8/1/2008	100	6.92	149.00	6.48	29.65	0.16	0.26	104.00
8/26/2008	100	7.02	74.40	7.72	17.62	0.18	0.29	107.00
9/24/2008	200	7.09	109.00	4.18	23.71	0.18	0.28	43.00
10/30/2008	300	7.56	114	9.5	16.32	0.17	0.26	-3
11/25/2008	275	7.06	178	11.08	14.74	0.17	0.263	-2
12/19/2008	200	6.43	173	8.65	20.71	0.17	0.266	183
1/30/2009	200	7.07	176	6.18	16.53	0.17	0.266	63
2/17/2009	150	7.04	190	9.94	15.56	0.21	0.322	77
3/21/2009		6.96	391	3.73	18.01	0.22	0.341	-5
4/30/2009	200	8.22	335	7.7	21.80	0.24	0.377	-6
5/1/2009	150	7.06	528	3.27	37.33	0.21	0.338	224
6/23/2009	100	6.21	290	4.7	26.94	0.21	0.330	239
7/23/2009	100	7.11	318	4.39	20.11	0.22	0.341	188
8/25/2009	100	7.79	462	8.3	21.08	0.23	0.346	83
9/30/2009		7.02	219	3.59	17.45	0.25	0.386	-19
10/29/2009	150	7.43	306	6.16	22.11	0.26	0.392	-25
11/19/2009	100	6.96	319	6.3	16.28	0.19	0.293	397
12/31/2009	125	7.11	262	6.02	15.4	0.23	0.361	311
1/25/2010	125	6.82	495	4.32	15.16	0.22	0.338	423
2/23/2010	100	6.97	484	7.27	11.72	0.3	0.466	303
3/23/2010	100	7.92	563	6.81	14.2	0.26	0.406	309
4/21/2010	80							
5/27/2010	100	6.93	452	4.13	33.57	0.28	0.441	210
6/23/2010	75	7.28	543	4.32	37.82	0.29	0.427	118
7/29/2010	100	7.4	-	4.73	36.05	0.3	0.452	84
8/23/2010	75	6.87	801	5.76	28.82	0.29	0.447	150
9/29/2010	100	7.43	997	6.52	24.06	0.3	0.444	-
10/27/2010	75	7.26	999	6.5	21.43	0.28	0.427	157
11/16/2010	50	7.79	870	6.57	16.84	0.29	0.442	166
12/23/2010	60	9.22	952	2.92	9.37	0.29	0.45	29

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leak Detection Zone Sampling**  
**Cell 4**

Sample Date	Vol Collected (gal)	On-site Testing Parameter (unit)						
		pH	Turb (NTU)	DO (g/L)	Temp C	TDS (g/L)	Cond. (S/cm)	ORP (mV)
12/12/2007	-	-	-	-	-	-	-	-
1/29/2008	-	-	-	-	-	-	-	-
2/20/2008	-	-	-	-	-	-	-	-
3/25/2008	25	6.47	317	8.90	19.70	0.11	0.17	-78.00
4/23/2008	-	-	-	-	-	-	-	-
5/29/2008	-	-	-	-	-	-	-	-
6/23/2008	-	-	-	-	-	-	-	-
8/1/2008	-	-	-	-	-	-	-	-
8/26/2008	-	-	-	-	-	-	-	-
9/24/2008	-	-	-	-	-	-	-	-
10/30/2008	-	-	-	-	-	-	-	-
11/25/2008	-	-	-	-	-	-	-	-
12/19/2008	-	-	-	-	-	-	-	-
1/30/2009	-	-	-	-	-	-	-	-
2/17/2009	-	-	-	-	-	-	-	-
3/21/2009	-	-	-	-	-	-	-	-
4/30/2009	-	-	-	-	-	-	-	-
5/1/2009	-	-	-	-	-	-	-	-
6/23/2009	-	-	-	-	-	-	-	-
7/23/2009	-	-	-	-	-	-	-	-
8/25/2009	-	-	-	-	-	-	-	-
9/30/2009	NA	6.82	447	6.71	17.86	0.14	0.214	-19
10/29/2009	-	-	-	-	-	-	-	-
11/19/2009	-	-	-	-	-	-	-	-
12/31/2009	-	-	-	-	-	-	-	-
1/25/2010	-	-	-	-	-	-	-	-
2/23/2010	-	-	-	-	-	-	-	-
3/23/2010	-	-	-	-	-	-	-	-
4/21/2010	-	-	-	-	-	-	-	-
5/27/2010	-	-	-	-	-	-	-	-
6/23/2010	-	-	-	-	-	-	-	-
7/29/2010	-	-	-	-	-	-	-	-
8/23/2010	-	-	-	-	-	-	-	-
9/29/2010	-	-	-	-	-	-	-	-
10/27/2010	-	-	-	-	-	-	-	-
11/16/2010	-	-	-	-	-	-	-	-
12/23/2010	-	-	-	-	-	-	-	-

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leak Detection Zone Sampling**  
**Cell 5**

Sample Date	Vol Collected (gal)	On-site Testing Parameter (unit)						
		pH	Turb (NTU)	DO (g/L)	Temp C	TDS (g/L)	Cond. (S/cm)	ORP (mV)
12/12/2007	-	-	-	-	-	-	-	-
1/29/2008	-	-	-	-	-	-	-	-
2/20/2008	-	-	-	-	-	-	-	-
3/25/2008	175	6.78	149.00	10.60	20.20	0.30	0.46	-108.00
4/23/2008	150	6.62	123.00	6.88	27.15	0.29	0.44	-29.00
5/29/2008	175	7.09	177.00	10.35	20.33	0.30	0.48	233.00
6/23/2008	NA	-	-	-	-	-	-	-
8/1/2008	250	6.75	106.00	3.57	25.62	0.30	0.45	51.00
8/26/2008	400	6.88	115.00	6.23	20.83	0.32	0.50	52.00
10/30/2008	500	6.82	150.00	5.02	24.46	0.29	0.45	26.00
11/25/2008	625	6.96	209.00	12.87	9.88	0.28	0.44	160.00
12/19/2008	650	6.42	127.00	6.78	23.46	0.30	0.45	83.00
1/30/2009	300	6.92	213.00	9.04	18.93	0.31	0.467	53.00
2/17/2009	200	7.09	351.00	9.30	16.69	0.30	0.45	156.00
3/21/2009	NA	6.57	305.00	1.51	21.13	0.31	0.477	-16.00
4/30/2009	225	8.09	254.00	6.95	27.59	0.31	0.47	188.00
5/1/2009	375	6.87	478.00	7.77	27.83	0.30	0.46	49.00
6/23/2009	200	6.91	286.00	4.32	20.31	0.31	0.48	144.00
7/23/2009	350	6.72	364	2.55	18.61	0.32	0.485	157
8/25/2009	325	7.1	364	6.63	19.64	0.32	0.485	110
9/30/2009	NA	7.27	412	6	19.33	0.33	0.508	26
10/29/2009	400	7.36	298	6.39	19.92	0.32	0.497	297
11/19/2009	450	7.05	376	6.23	17.92	0.32	0.507	269
12/31/2009	475	6.86	482	0	12.73	0.32	0.493	274
1/25/2010	500	6.4	471	0.03	16.59	0.32	0.491	403
2/23/2010	500	6.61	565	1.98	16.45	0.32	0.5	431
3/23/2010	500	7.63	607	2.87	14.93	0.34	0.53	365
4/21/2010	900							
5/27/2010	600	6.95	599	4.73	18.61	0.34	0.526	403
6/23/2010	475	7.75	561	5.6	25.4	0.38	0.582	-35
7/29/2010	490	7.21	822	2.34	21.92	0.35	0.545	72
8/23/2010	500	7.27	738	3.18	18.18	0.35	0.541	263
9/29/2010	550	6.91	999	3.62	18.06	0.35	0.547	131
10/27/2010	500	6.87	752	4.73	25.52	0.35	0.545	11
11/16/2010	525	7.24	837	4.61	22.32	0.37	0.584	-43
12/23/2010	425	7.72	631	1.96	10.38	0.36	0.587	127

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leak Detection Zone Sampling**  
**Cell 6**

Sample Date	Vol Collected (gal)	On-site Testing Parameter (unit)						
		pH	Turb (NTU)	DO (g/L)	Temp C	TDS (g/L)	Cond. (S/cm)	ORP (mV)
12/12/2007	340	6.91	26.4	6.08	17.16	-	0.603	-172
1/29/2008	-	-	-	-	-	-	-	-
2/20/2008	1050	6.76	45.8	3.94	15.81	-	0.423	-108
3/25/2008	2150	6.85	43.8	5.58	16.6	0.27	0.418	-108
4/23/2008	775	6.78	79.50	7.01	18.21	0.18	0.284	39.00
5/29/2008	800	7.42	175.00	8.93	20.83	0.22	0.359	76.00
6/23/2008	850	7.76	174.00	3.59	18.46	0.25	0.386	144.00
8/1/2008	950	6.76	68.40	4.40	17.98	0.20	0.313	23.00
8/26/2008	800	6.62	71.20	2.83	16.62	0.22	0.331	30.00
9/24/2008	775	7.57	105.00	7.25	15.52	0.22	0.342	-58.00
10/30/2008	800	7.14	94.70	5.28	15.48	0.20	0.305	-30.00
11/25/2008	800	6.65	147.00	5.60	14.09	0.21	0.311	50.00
12/19/2008	725	6.76	163.00	3.40	17.43	0.21	0.324	23.00
1/30/2009	650	7.20	231.00	11.90	10.79	0.30	0.455	49.00
2/17/2009	400	6.80	221.00	5.33	14.87	0.23	0.348	89.00
3/21/2009	NA	7.16	318.00	5.91	17.25	0.22	0.32	67.00
4/30/2009	450	7.79	274.00	6.30	17.15	0.22	0.34	346.00
5/1/2009	475	7.23	222.00	4.47	28.34	0.22	0.35	328.00
6/23/2009	625	6.62	379.00	4.62	18.11	0.23	0.36	189.00
7/23/2009	700	6.93	293.00	4.61	30.70	0.21	0.33	-16.00
8/25/2009	700	6.67	227.00	6.16	28.78	0.22	0.33	-27.00
9/30/2009	NA	6.95	323.00	7.39	17.38	0.23	0.35	-52.00
10/29/2009	550	7.44	307.00	6.37	18.81	0.26	0.39	-28.00
11/19/2009	475	6.54	353.00	5.44	18.14	0.22	0.35	216.00
12/31/2009	475	6.99	368.00	8.14	9.90	0.24	0.36	384.00
1/25/2010	350	7.00	633.00	4.31	14.74	0.23	0.36	265.00
2/23/2010	300	6.91	476.00	7.20	15.95	0.23	0.36	128.00
3/23/2010	340	7.31	472.00	7.72	14.76	0.22	0.34	325.00
4/21/2010	320							
5/27/2010	300	7.24	565.00	5.20	29.61	0.29	0.44	-63.00
6/23/2010	300	7.06	517.00	4.21	36.18	0.25	0.37	153.00
7/29/2010	300	7.33	-	4.37	34.95	0.25	0.38	247.00
8/23/2010	300	7.29	896.00	7.42	21.34	0.32	0.51	-40.00
9/29/2010	350	7.13	999.00	6.78	24.20	0.27	0.41	26.00
10/27/2010	325	7.28	926.00	7.49	19.81	0.26	0.40	39.00
11/16/2010	350	7.72	779.00	7.56	17.08	0.23	0.36	164.00
12/23/2010	300	9.15	-	2.41	8.33	0.29	0.44	-72.00

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Leak Detection Zone Sampling**  
**Leachate Pond**

Sample Date	Vol Collected (gal)	On-site Testing Parameter (unit)						
		pH	Turb (NTU)	DO (g/L)	Temp C	TDS (g/L)	Cond. (S/cm)	ORP (mV)
12/12/2007	0	-	-	-	-	-	-	-
1/29/2008	0	-	-	-	-	-	-	-
2/20/2008	0	-	-	-	-	-	-	-
3/25/2008	0	-	-	-	-	-	-	-
4/23/2008	0	-	-	-	-	-	-	-
5/29/2008	0	-	-	-	-	-	-	-
6/23/2008	0	-	-	-	-	-	-	-
8/1/2008	0	-	-	-	-	-	-	-
8/26/2008	0	-	-	-	-	-	-	-
9/24/2008	0	-	-	-	-	-	-	-
10/30/2008	0	-	-	-	-	-	-	-
11/25/2008	0	-	-	-	-	-	-	-
12/19/2008	0	-	-	-	-	-	-	-
1/30/2009	0	-	-	-	-	-	-	-
2/17/2009	0	-	-	-	-	-	-	-
3/21/2009	0	-	-	-	-	-	-	-
4/30/2009	0	-	-	-	-	-	-	-
5/1/2009	0	-	-	-	-	-	-	-
6/23/2009	0	-	-	-	-	-	-	-
7/23/2009	0	-	-	-	-	-	-	-
8/25/2009	0	-	-	-	-	-	-	-
9/30/2009	0	-	-	-	-	-	-	-
10/29/2009	0	-	-	-	-	-	-	-
11/19/2009	0	-	-	-	-	-	-	-
12/31/2009	0	-	-	-	-	-	-	-
1/25/2010	0	-	-	-	-	-	-	-
2/23/2010	0	-	-	-	-	-	-	-
3/23/2010	0	-	-	-	-	-	-	-
4/21/2010	0	-	-	-	-	-	-	-
5/27/2010	0	-	-	-	-	-	-	-
6/23/2010	0	-	-	-	-	-	-	-
7/29/2010	0	-	-	-	-	-	-	-
8/23/2010	0	-	-	-	-	-	-	-
9/29/2010	0	-	-	-	-	-	-	-
10/27/2010	0	-	-	-	-	-	-	-
11/16/2010	0	-	-	-	-	-	-	-
12/23/2010	0	-	-	-	-	-	-	-

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Flare Station - Gas Flow Rates**

<b>Date</b>	<b>Flow Rate (scfm)</b>
10/27/2005	410
10/31/2005	392
11/2/2005	339
11/8/2005	289
11/14/2005	352
12/12/2005	320
12/22/2005	312
4/11/2007	230
5/7/2007	230
6/7/2007	250
7/17/2007	260
8/5/2007	260
9/27/2007	525
10/25/2007	550
10/26/2007	400
11/30/2007	300
12/31/2007	300
1/5/2008	300
1/14/2008	260
1/24/2008	260
5/6/2008	350
8/12/2008	250
8/14/2008	225
8/15/2008	225
8/16/2008	225
8/17/2008	225
8/18/2008	225
8/19/2008	225
8/20/2008	225
8/21/2008	225
8/22/2008	225
8/23/2008	225
8/24/2008	225
8/25/2008	225
8/26/2008	225
8/27/2008	225

**Buncombe County Solid Waste Management Facility**  
**Subtitle D Landfill**  
**Settlement Plate Monitoring Data**

Date	Settlement Plates (Elevation - ft)									
	SP-1	SP-2	SP-3	SP-4	SP-5	SP-6	SP-7	SP-8	SP-9	SP-10
January-06	2,027.08	2,047.57	2,066.80	2,062.16	2,047.00	2,067.06	2,078.92	2,051.61	2,073.77	2,062.62
July-06	2,026.98	2,047.47	2,066.70	2,062.07	2,046.95	2,066.99	2,078.92	2,051.47	2,073.46	2,062.46
September-06	2,026.95	2,047.43	2,066.65	2,062.02	2,046.92	2,066.98	2,078.93	2,051.44	2,073.41	2,062.44
October-06	2,026.94	2,047.43	2,066.63	2,062.02	2,046.90	2,066.96	2,078.68	2,051.43	2,073.36	2,062.40
November-06	2,026.91	2,047.41	2,066.61	2,061.98	2,046.88	2,066.96	2,078.66	2,051.42	2,073.32	2,062.39
December-06	2,026.90	2,047.40	2,066.61	2,061.98	2,046.86	2,066.96	2,078.62	2,051.40	2,073.31	2,062.39
January-07	2,026.91	2,047.40	2,066.61	2,061.97	2,046.85	2,066.95	2,078.58	2,051.39	2,073.27	2,062.37
February-07	2,026.90	2,047.38	2,066.60	2,061.96	2,046.85	2,066.90	2,078.53	2,051.34	2,073.21	2,062.31
March-07	2,026.89	2,047.36	2,066.60	2,061.95	2,046.85	2,066.85	2,078.49	2,051.29	2,073.15	2,062.25
April-07	2,026.88	2,047.34	2,066.58	2,061.95	2,046.85	2,066.84	2,078.47	2,051.28	2,073.10	2,062.23
May-07	2,026.87	2,047.33	2,066.58	2,061.96	2,046.86	2,066.86	2,078.48	2,051.30	2,073.11	2,062.25
June-07	2,026.88	2,047.33	2,066.60	2,061.97	2,046.87	2,066.87	2,078.46	2,051.27	2,073.09	2,062.23
July-07	2,026.87	2,047.32	2,066.58	2,061.94	2,046.88	2,066.89	2,078.46	2,051.28	2,073.07	2,062.22
August-07	2,026.87	2,047.33	2,066.58	2,061.97	2,046.88	2,066.87	2,078.43	2,051.26	2,073.05	2,062.21
September-07	2,026.87	2,047.30	2,066.59	2,061.95	2,046.88	2,066.88	2,078.45	2,051.27	2,073.05	2,062.23
October-07	2,026.86	2,047.31	2,066.58	2,061.94	2,046.87	2,066.86	2,078.43	2,051.26	2,073.03	2,062.23
November-07	2,026.87	2,047.31	2,066.58	2,061.92	2,046.88	2,066.84	2,078.40	2,051.23	2,072.99	2,062.19
December-07	2,026.84	2,047.27	2,066.54	2,061.89	2,046.83	2,066.86	2,078.31	2,051.24	2,072.98	2,062.20
January-08	2,026.83	2,047.26	2,066.54	2,061.87	2,046.83	2,066.86	2,078.39	2,051.21	2,072.95	2,062.18
February-08	2,026.83	2,047.26	2,066.54	2,061.89	2,046.82	2,066.88	2,078.37	2,051.20	2,072.92	2,062.16
March-08	2,026.83	2,047.23	2,066.52	2,061.86	2,046.81	2,066.82	2,078.34	2,051.18	2,072.88	2,062.13
June-08	2,026.82	2,047.21	2,066.52	2,061.87	2,046.84	2,066.81	2,078.29	2,051.12	2,072.80	2,062.09
October-08	2,026.81	2,047.20	2,066.50	2,061.86	2,046.83	2,066.85	2,078.29	2,051.14	2,072.78	2,062.09
February-09	2,026.76	2,047.14	2,066.46	2,061.82	2,046.85	2,066.84	2,078.27	2,051.11	2,072.71	2,062.06
June-09	2,026.74	2,047.09	2,066.42	2,061.78	2,046.77	2,066.80	2,078.17	2,051.04	2,072.59	2,061.98
September-09	2,026.72	2,047.06	2,066.40	2,061.76	2,046.76	2,066.80	2,078.16	2,051.03	2,072.55	2,061.97
January-10	2,026.70	2,047.03	2,066.37	2,061.74	2,046.75	2,066.78	2,078.11	2,051.00	2,072.45	2,061.93
April-10	2,026.68	2,047.01	2,066.38	2,061.74	2,046.75	2,066.80	2,078.12	2,051.01	2,072.43	2,061.93
August-10	2,026.66	2,047.00	2,066.36	2,061.72	2,046.75	2,066.75	2,078.05	2,050.94	2,072.33	2,061.86
November-10	2,026.63	2,046.97	2,066.34	2,061.71	2,046.73	2,066.75	2,078.03	2,050.94	2,072.26	2,061.85



